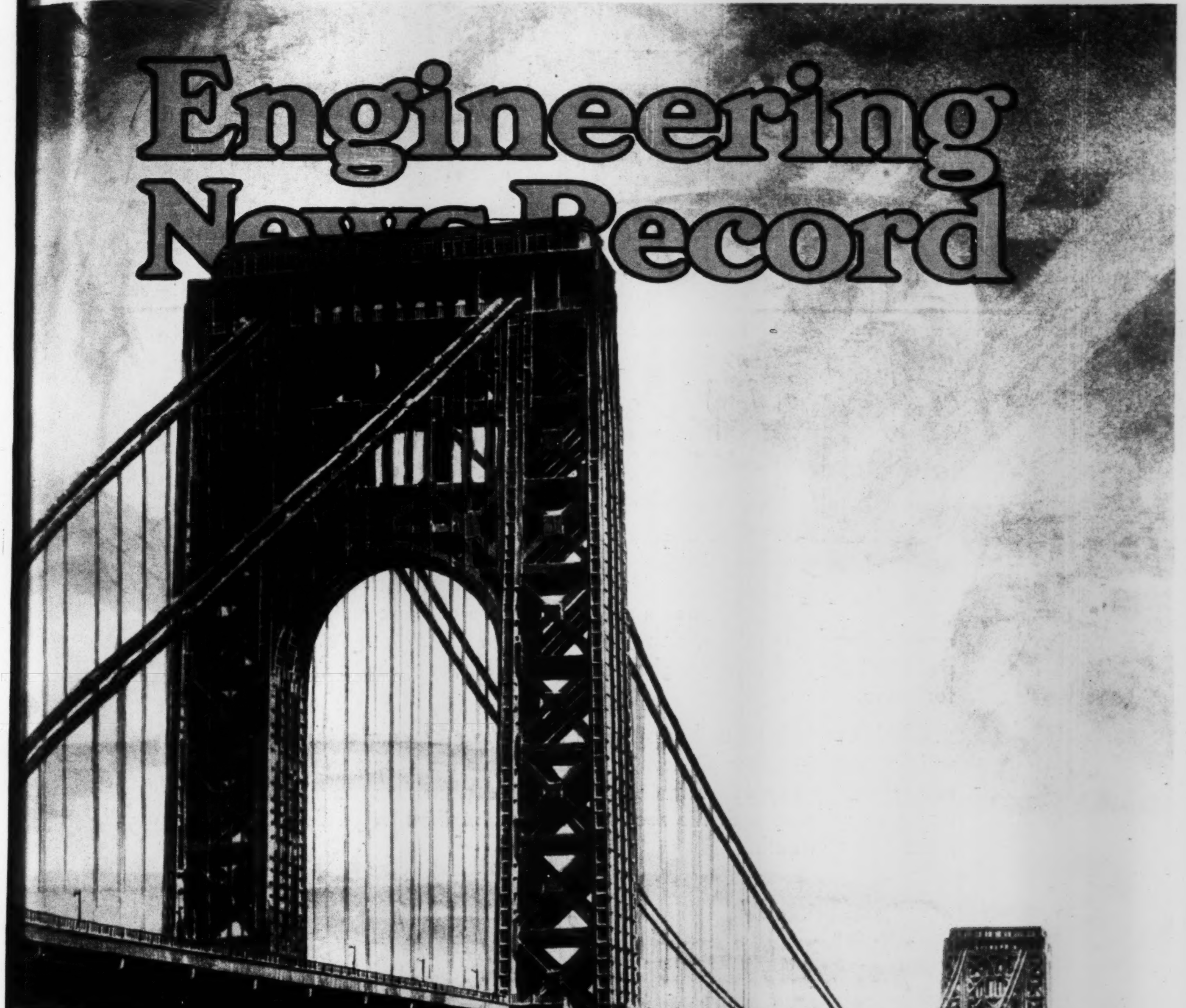
Engineering
Library

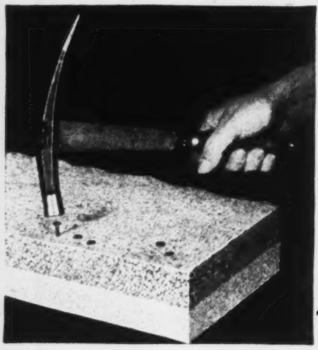
OCT 2

ctober 22, 1931 McGraw-Hill Publishing Company, Inc. 25 Cents $5 per Year

Engineering News-Record



Hudson River Bridge at New York —*From a lithograph by J. Floyd Yewell*



81% better grip on the nails - *than wood!*

Results of actual tests on *nail-pull* by two of the country's foremost engineering laboratories, show an average of *139.9 pounds* required to pull a nail out of Featherweight Nailing Concrete, as against only *77 pounds* for wood.

This exceptional nail-gripping power is your assurance that Featherweight Precast Nailing Concrete Slabs will hold the ornamental roof more securely than any other material you could possibly use. The original uniform appearance of the roof is always maintained, regardless of wind pressure and weather.

Featherweight Nailing CONCRETE ROOF SLABS

have special nailing surface cast integrally—take the nails easily—are light in weight to save roof steel—have new insulating value—are permanent, fireproof, no-maintenance. They are in use on prominent public and private buildings everywhere—Government buildings as well as others. "Catalog and Roof Standards" on request.

Made, Laid and Guaranteed by

FEDERAL-AMERICAN
CEMENT TILE CO.
Executive Offices: 608 South Dearborn Street - - - - - Chicago
Plants Near CHICAGO - NEW YORK - PITTSBURGH - BIRMINGHAM
FOR OVER A QUARTER CENTURY

ENGINEERING NEWS-RECORD

Editorial Staff
New York
V. T. BOUGHTON
Managing Editor
M. N. BAKER
C. S. HILL
W. G. BOWMAN
H. W. RICHARDSON
R. B. GARRABRANT

A Consolidation of Engineering News, Engineering Record,
The Sanitary Engineer, and The Contractor

F. E. SCHMITT, *Editor*

Editorial Staff
Chicago
W. W. DEBERARD
E. E. R. TRATMAN
F. W. HERRING
San Francisco
N. A. BOWERS
J. I. BALLARD

WILLARD CHEVALIER
Publishing Director

❖

Contents for October 22, 1931

VOLUME 107, NUMBER 17
Copyright, 1931, by McGraw-Hill Publishing Company, Inc.

A Group of Articles on the

World's Largest Suspension Bridge

Bridging the Hudson at Fort Lee 640

Erecting Towers and Floor Steel 646
BY AUSTIN S. HALTEMAN

Ingenious Form System Speeds Up Floor Paving 654

Complex Approaches Promote Efficient Use of Bridge 657

Well Points Drain Swamp Under Bridge Approach 665

Editorial 637 Letters 666
News 667 Equipment 673

❖

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.
CHICAGO, 520 North Michigan Ave. 883 Mission St., SAN FRANCISCO Aldwych House, Aldwych, LONDON, W.C. 2

JAMES H. MCGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. MCGRAW, JR., Vice-Pres. and Treas.
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
HAROLD W. MCGRAW, Vice-President
H. C. PARMELEE, Editorial Director
C. H. THOMPSON, Secretary

Published weekly. $5 per year. Foreign postage, $4. Canada (including Canadian duty), $7.50. 25 cents per copy. Entered as second-class matter April 11, 1917, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

CABLE ADDRESS: "MACHINIST, N. Y."

Member A.B.P. Member A.B.C.

WASHINGTON, National Press Building
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
DETROIT, 2-257 General Motors Building
ST. LOUIS, 1556 Bell Telephone Building
BOSTON, 1427 Statler Building
GREENVILLE, S. C., 1301 Woodside Building
LOS ANGELES, 632 Chamber of Commerce Building

NUMBER OF COPIES PRINTED THIS ISSUE, 29,896

STANDARD

REG. U.S. PAT. OFF.

Selected by

STANDARD OIL of NEW JERSEY

The design and construction of a Research Laboratory Building at the Bayway Refinery of the Standard Oil Company of New Jersey is one of a great variety of our current projects. These include office buildings, industrial steam stations, factories, laboratories, pipe-line work, hydro-electric and steam developments as well as reports and appraisals. Coal, oil, copper, utility, and manufacturing concerns of wide diversity are included in the list.

This broad experience is available to you for report and appraisal work and any problem of design and construction.

BUILDERS and ENGINEERS
for the
BUSINESS LEADERS *of* AMERICA

STONE & WEBSTER ENGINEERING CORPORATION

A Subsidiary of Stone & Webster, Incorporated

Associated in Canada with WILLIAM McCLELLAN and COMPANY, Limited, Montreal

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL OF CIVIL ENGINEERING AND CONSTRUCTION PRACTICE

Volume 107 ✦ Established 1874 ✦ McGraw-Hill Publishing Company, Inc. ✦ Number 17

F. E. Schmitt, Editor

OCTOBER 22, 1931

✦

A Chronicle of Great Engineering

OPENING of the Hudson River bridge at New York on Oct. 24 marks the successful completion of the most impressive as well as the greatest engineering structure of this generation. The development of its design and the progress of its construction have been subjects of discussion wherever engineers have gathered during the past six or seven years. As various stages of the project have been completed, this journal has attempted to record the significant facts for its readers, and the result has been a sizable group of articles. In the present issue we add to the group by devoting most of our space to a series of articles touching on those phases of the project that have heretofore not been described. Tower and floor steel erection are treated in detail. A comprehensive account of the New York and New Jersey approaches is given. Interesting construction procedure used in paving the roadway is described. While the design of the bridge was analyzed in considerable detail in July, 1927, before bids were received, there is given in this issue a detailed review of the design as it was actually executed. Reading of this issue together with reference to the articles previously published should provide a complete picture of this significant project.

Your Help Needed

THE move to find work for engineers now out of work is making good progress. Following closely upon the promulgation of an outline plan for local relief measures by the board of direction of the American Society of Civil Engineers at its St. Paul meeting, Chicago engineers last week took up the task of fitting the general recommendations to their specific problems. Their planning calls for the centralization of relief work for all engineers in one committee. In New York, the proposal of the Metropolitan Section of the Am.Soc.C.E. to set up an organization to seek financial aid and opportunities for work for unemployed engineers has received hearty endorsement by other societies, and in a short time all engineer relief work will clear through one central committee. That committee is being organized as this issue goes to press. Committees, however, can do little without help and support from the engineering profession generally. Their work, in so far as possible, will be integrated with that of local unemployment relief committees, essentially in seeking out, planning for and wherever possible directing work which the community can have carried out to provide work for the greatest possible number of unemployed. But the engineers' committees will need money, money to stake the men who seek out possible jobs for community relief work until such time as the jobs develop to the point where the community relief agency can take them over, and money for loans or direct relief for men who cannot be cared for in that way. A call for contributions will go out as soon as the engineers' committees can get organized to handle the funds. That call must not be overlooked if the plan is to succeed. The help of *every* engineer who still has a job is needed.

Creative Power

THAT extraordinary genius who has just departed, Thomas A. Edison, was so closely interwoven with the life of all men that we may easily lose sight of his profound influence on the life and work of the civil engineer. The vast electrical industry, which he may be said to have founded and of which his creations and his great commercial gifts were the mainspring, has extended the field of engineering construction immeasurably. Its direct and indirect needs make possible a large part of the profession's activities today; without its power generating and distributing plant, its manufactories, its effect in dispersing industry widely over the land, its magic influence on community growth and wealth of services, civil engineering would be poor and backward. Industry and worker too would be incomparably less fruitful and prosperous. It is creative invention to which we owe the marvelous advance toward those conditions that we please to call modern. Strange that with such evidence before us there are those who talk of "technological unemployment," who cry down invention and betterment as an evil, a source of unemployment and misery! Can anyone, in contemplation of Edison's influence on human affairs, abandon enthusiasm for the pursuit of improvement and efficiency or believe that a single man is harmed by progress?

Aiding the Cause

WITH highway construction taking a prominent part in the move to lessen unemployment, any steps to increase the use of labor without resorting to uneconomical practices are noteworthy. The Bureau of Public Roads is, therefore, to be commended for its recent action in removing some of the restrictions to participation in federal aid in the interest of unemployment relief. It will now be possible on federal-aid work for the states to set a fair common wage scale, to be stated in the call for bids; local labor may be given preference; part-time labor may be employed on a rotation basis; and force-account work way be used in emergencies. Dispensing with former restrictions prohibiting these measures will occasion little appreciable increase in cost or lessen the efficiency of highway construction. Under the new arrangements a more direct attack on local unemployment will be possible. On the other hand, the bureau has strongly emphasized its stand against barring out-of-state contractors and materials. Penalizing the public by paying a premium for local construction firms and materials will not be tolerated on federal-aid projects. The same principle should apply to all public construction work. Sound business policy applies to unemployment relief through public works as much as to any other construction.

Saving Knowledge

ENGINEERING firms and company representatives continue to be, as always, active participants in technical society meetings. They bring much to these meetings in the way of information and experience and take away at least as much in the shape of knowledge of what other engineers have learned or done and a better understanding of current trends of practice. Usually the information which they take home from a meeting is recorded in their memory alone, which is rather perishable storage and is likely to make the information useless to their office colleagues. One firm has set up a system of procedure by which this stored knowledge is made accessible and is saved for continued use. Its firm members or other representatives at technical meetings take notes of the proceedings and later transcribe them in a report, summarizing everything related to the firm's field of work. The report is then read by the other members and is filed for permanent reference, with cross-index entries in subject files as required. This procedure assures to the firm fullest return for its expenditure in attending the meeting. But it has value aside from the gain to the firm itself. It helps other engineers, and in fact the public at large, by assuring quicker and more complete application of every technical advance than would otherwise be obtained. It commends itself to other engineering firms in their own interest.

Economy and Safety

IN THESE days economy in design has exceptional importance. Limited resources and credit are imperative motives for cost reduction, and the designer's problem therefore is to apply every available device for cheapening construction. But in striving for these economies it is vital to remember the demands of safety. Such principles as carrying the main frame direct to the foundation, and avoiding the support of roof trusses and other heavily loaded members on masonary walls, save under exceptional conditions, need to be recalled as primary doctrines of good design. An ample record of experience supports these safety practices, but the record is scattered and its force is therefore easily forgotten. Likewise the demands of fire-protective construction and adequate exit facilities may not be overlooked except at gravest risk. The responsibility rests on the designing engineer. Seasoned experience is fairly certain to give full weight to the necessity of following established safety practices, but those engineers who have not studied the record of past accidents, the younger men particularly, may tend to undervalue some practices that are essential to safe construction. Since it is likely that every designer in some part of his work is affected by such incompleteness of knowledge, a substantial degree of conservatism in design appears desirable. Each proposed economy expedient ought to be subjected to searching inquiry as to its adequacy under every reasonably possible condition before it is adopted in place of normal design.

The Hudson Is Bridged

ON THE morning of Oct. 25, after its christening a day earlier, the great suspension bridge over the Hudson River at New York will be thrown open to public traffic and thereby will become a routine part of the world's service facilities. It dwarfs the noblest works of prior bridge construction. It represents the fruit of a hundred years of dreaming and more than fifty years of concrete planning to span the three-quarter-mile breadth of water that divides Manhattan Island from the New Jersey mainland. Engineering skill converted the dreaming and planning to reality, but it could do so only because the way was cleared by advance in human cooperation.

For nearly six years the engineers have been struggling with the intricate problems of design and construction. The work called upon the full powers of civil engineering and its supporting industries and crafts. To the men who marshaled and directed these powers wisely, ingeniously and efficiently, highest praise is due. Perhaps the bridge could have been built fifty years ago. Knowledge of calculation and design, though more primitive than now, could have mastered its problems. The practical arts of construction might also have succeeded in their part of the work, though only at the cost of prodigious effort and hazard. But what the present engineers have wrought is on a new level of achievement. The smooth and uneventful creation of the great structure in little more than five years, ahead of schedule and within the advance estimates of cost, is the product of a new generation of engineering skill, which commands remarkably increased power over mud, water, rock and steel.

And this achievement of modern engineering is such as to give the bridge lasting fame the world over. It was predestined to fame, as we may realize if we contemplate the rich background of history that distinguishes the undertaking, the many eminent engineers of this and other countries who labored on the early projects and designs, the investigating commissions that studied sites and plans, and the lengthy debates in engineering circles which discussed the problems involved. But inherited fame did not build the bridge. The fame of accomplishment sprang from the vision and courage of its principal genius, O. H. Ammann, supplemented by changed conditions and new ways of human organization that swept aside the legal, political and financial obstacles encountered by earlier projects.

The significance of these new developments in human cooperation gives them rank with the engineering achievement. Consider for a moment the changes that a half century has brought. In the early days of Hudson River bridge planning railway transportation was the chief or sole objective. Railway managers, however, could not agree sufficiently to assure the soundness of a great bridge enterprise. When highway transportation grew until it became the chief claimant for a crossing, the whole community had a direct interest; unity of thought became crystallized into conviction, and action waited only a suitable agency. Private projects had found seemingly hopeless difficulties in dealing with states, cities and other authorities, and in solving the appalling problems of financing. Within the last ten years toll bridge construction by public agencies proved its strength, showing that not only could it establish a sound basis for financing but also it could easily cope with the political and legal problems so serious to private construction.

After large-scale proof given by the Delaware River Bridge and the Holland tunnels, all was ready for applying this efficient system of cooperation to the Hudson River Bridge undertaking. The Port of New York Authority became the bridgebuilding agency.

No less influential was the rapid northward shift of population and cross-river traffic. A midtown crossing was long thought the only possibility for a costly bridge. In time, however, the argument for a crossing far in the north of the island won increasing acceptance. And so, bit by bit, a wholly new set of governing conditions came to exist, and the huge undertaking was begun.

Great works of construction make history. The Fort Lee bridge, while making history for the extensive region that it serves, also marks an epoch in the annals of civil engineering. In virtually every element, from its towers and anchorages to its cables, its unstiffened deck, its ingenious floor construction, its provision for double-decking, and not least its unprecedented traffic-distributing approaches, which will make the operating efficiency of the bridge a match for its efficiency and economy of construction, it establishes a new datum from which future bridge engineering will take its measure.

Bridge engineering has erected for itself a lasting monument—yes, even an imperishable one, we hopefully believe. Loads and storms will not destroy it; even the all but impossible chance of earthquake is not greatly to be feared; what the tooth of time may do is for future generations to observe and control. In its superb natural setting between the New Jersey Palisades and the rocky promontory of Washington Heights the Hudson River bridge will stand, we trust, for centuries as the symbol of today's bridgebuilding, even as the Brooklyn bridge has represented an earlier era.

Wanted—A Catalyst

CATALYSTS, powerful tools of the chemist, make possible many wonders of modern creation. When the chemist wants to combine two substances, and finds on mixing them that they remain separate despite heat and pressure, he adds a small amount of a third substance, a catalyst—and the two unfriendly substances promptly combine.

Let construction go to the chemist and learn the secret of his catalysts. The many diverse components of construction—the planner, the money-provider, the manager, the builder, the worker, the material man, the machine maker, the insurer, the seller—are separate, individualistic elements and have been so since an early day. They cooperate when cooperation is unavoidable, but only for the moment and only because it is unavoidable. Result: their many joint problems remain unsolved, because they can be solved only by joint action.

This is well known to most of those engaged in construction. And they have tried time and again to join and work out their problems together. But the attempt has always failed. It seems that the right catalyst was never found. Now, a new attempt at cooperation is made, this time through the Construction League of the United States, a get-together quite similar to its predecessors. Auspicious circumstances attend the League's beginning. An architect, an engineer and a contractor are in the brass-hat positions; an employing plumber is secretary. Apparently a broad spirit of cooperation is present. Other conditions are less auspicious; the League starts without program or very clearly stated objective; worst of all, it groups some thirty employers with one single spokesman of labor.

Yet these conditions will not necessarily make or break the new organization. The chemist's experience is the clue. The proportions of the mixture may not be quite correct, and the temperature a bit low, and yet the combination may succeed if the right catalyst is present.

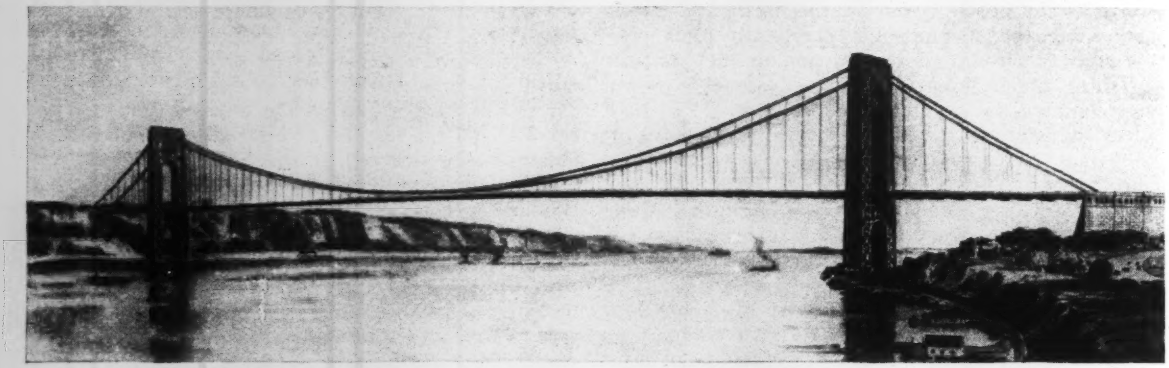
What catalyst can make the construction industry combine we do not know. It may be genius. It may be penetrating insight into the intimate relationships of the construction units. It may be some intangible power over very stubborn and self-centered kinds of men, to persuade them into working together. Perhaps no such catalyst exists; the minds and problems involved in construction may be so refractory that nothing can bring about union. But we have faith that it is possible to find the secret of success.

Less Roadbuilding in Sight

THIS week the allotment of the 1932-33 appropriation for federal-aid roads was announced. Its figures show that the federal government is beginning to collect installments to repay the $80,000,000 emergency loan made to state highway departments last spring. From the $125,000,000 appropriation for the coming year, $16,000,000 is deducted for debt payment; each year, for four years more, the allotment of federal-aid money will be lessened by an equal amount. The $80,000,000 extra roadbuilding program completed in 1931 means that, for five years to come, federal-aid construction will be smaller by exactly 12.8 per cent if Congressional appropriations are kept at their emergency level of $125,000,000 a year, while if during the five years the old figure of $75,000,000 is restored—and this is not improbable—the reduction will be 21⅓ per cent.

These are serious reductions for many states to contemplate, and it is not surprising that such states are questioning whether the generosity of Congress in making the loan and the administration's activity in urging the states to accept and use the loan were wholly an advantage to the highway development of the states. Fortunately repayment is not required from their own tax money, or the reaction might easily be more pronounced. But even a reduction of gift money is hard to endure, and in most of the public-land states it is causing concern. What can be done, they ask, to maintain roadbuilding activities that this year have been expanded far beyond normal? A drastic cut in highway development appears unavoidable in these states unless Congresss increases federal aid sufficiently to compensate for the money held back to repay the loan which it made a year ago.

Will Congress take such action? If it does not, less road construction is certain in 1932 than for half a decade past. No considerable increase in motor-vehicle tax funds can be expected; increased property taxes for state roads will not be generally granted; counties and townships will continue, according to all evidence, to clamp tight down on all public-roads expenditures not demanded by necessity. If highway improvement in 1932 is to be held up to the figures of recent years it will be because greater sums than ever before of federal money are provided by the coming Congress. It will be the task of road-using as well as roadbuilding interests to convince Congress of this fact.



George Washington bridge over Hudson River connects 178th St., New York, with the Borough of Fort Lee in New Jersey by means of a main suspended span of 3,500 ft.

Bridging the Hudson at Fort Lee

The Engineering Design

Its controlling conditions, and the main elements of the 3,500-ft. suspension crossing just opened to traffic

MORE than 50 years of unsuccessful planning preceded the final achievement of the just completed suspension bridge across the Hudson between New York, N. Y., and Fort Lee, N. J., though the first beginnings of the executed project go back only eight years. The great span, nearly twice as long as the longest previous bridge spans—Quebec and Detroit—was designed as a suspension bridge because of the foundation conditions and because of its superior economy. In arrangement and detail it is characterized by great structural simplicity. The present structure is only the first stage of the final bridge, provision being made for adding a lower deck to carry rapid-transit trains. The main carrying members are four parallel-wire cables 36-in. in diameter; eyebar chains had also been designed, but the wire cable bids were lower. The floor is wide and heavy; because of the great cable and floor weight, the stiffening and wind systems are relatively unimportant. Unique steel towers support the cables; they may later be inclosed by concrete walls. One anchorage is of tunnel type, the other of gravity type.

Four years ago, on Nov. 4, 1927, contracts were let for building the superstructure of the Fort Lee Bridge over the Hudson River at New York, since named the George Washington Bridge. In preparation for the bidding, two alternative designs had been prepared, one with wire cables and the other with eyebar chains as main carrying members. These two designs were described in detail in *Engineering News-Record* of Aug. 11, 1927, p. 212. The wire-cable design brought the lowest bids, and was adopted for execution. On Oct. 25, 1931, the finished bridge will be opened to traffic, though parts of the approaches are still in temporary condition.

During the four years of construction the natural evolution of the design brought about numerous detail changes. Most of these are minor, but it seems proper at this time to record them and to acquaint the engineering world fully with the design as it was actually carried out. This is done for the main elements of the structure in the present article, while the tower and floor construction and the approaches are dealt with in immediately following articles. Other articles on the bridge have appeared in this journal as follows: "Design of Steel Towers," May 24, 1928, p. 819; "Deep Open Cofferdams for New Jersey Pier," Aug. 16, 1928, p. 232; "Construction of New Jersey Tunnel Anchorage," Oct. 25, 1928, p. 611; "Pouring 106,000-Cu.-Yd. Block of Concrete for New York Anchorage," April 11, 1929, p. 591; "Manufacturing High-Modulus Footbridge Rope," May 1, 1930, p. 714; and "Spinning Four 36-In. Cables for Fort Lee Bridge," Aug. 14, 1930, p. 242.

Distinguishing Characteristics

The new bridge occupies a position of peculiar note not only because of its great size but also because of its long history and its distinctive structural character. More than 50 years of planning went before its successful accomplishment. Its 3,500-ft. span outreaches in one prodigious bound the greatest prior achievenments in bridging—the 1,800-ft. spans of the Quebec cantilever over the St. Lawrence and of the Ambassador suspension bridge over the Detroit River. It is marked by many features of individuality, among others (1) double-deck construction; (2) provision for building the structure in two stages, of which only the first has so far been completed; (3) massive steel towers made up of four four-column arch bents; (4) four 36-in. parallel-wire cables set in pairs over the interior columns of the bents; (5) very shallow stiffening trusses in the final construction, and no stiffening trusses whatever in the first stage; (6) a rather flexible windbracing system in the floor, the main cables chiefly supplying the transverse stiffness; and (7) a highway deck of concrete-embedded steel joists.

To record its main dimensions: the main span is 3,500 ft. long, the suspended side spans 650 ft. each. The primary supports are two steel towers, 588 ft. high from mean water to center line of cables. They support four cables 36 in. in diameter, two side by side on either side of the towers. The cables hang in vertical planes. The present (upper) deck is 106 ft. wide and is planned to carry ultimately eight vehicle lanes. Each end of each floor beam is hung from four $2\frac{7}{8}$-in. suspender ropes looped over the cable bands. The future lower deck is to carry four rapid-transit railway trucks. When it is built, a light stiffening truss 29 ft. deep will be constructed on either side, in the space between the two decks; there is no stiffening truss at all in the present condition, but the upper chords of the future trusses are in place, serving as chords of the wind truss. The roadway is a $7\frac{1}{2}$-in. concrete slab incasing longitudinal bulb beams set 15 in. apart; there are two roadway strips 28 ft. 9 in. wide, separated by a 30-ft. middle strip left unpaved for the present. The future lower deck will afford a navigation clearance height of 213 ft. at midspan · the present clearance height is some 40 ft. greater.

Fifty Years of Planning

Bridging the Hudson at New York has been the subject of dreams and projects for more than 50 years. The width and depth of the waterway, its soft clay bottom, with rock far out of reach, the densely populated shores and the busy traffic both along and across the river were among the factors that either stimulated or discouraged such planning. Many designs were made, numerous locations were studied and divergent views on important questions of bridge design were developed, among them the views set forth in that engineering classic, "Maximum Spans for Suspension Bridges," prepared by a board of army engineers nearly 40 years ago.

Since the first bridge was proposed trans-Hudson traffic has increased greatly in volume; its center of gravity has moved north away from the congestion and high land values of downtown New York, and its governing conditions have changed so that while formerly a railway bridge was sought for, today the chief need is for highway crossing. These changes in volume and character of traffic largely determined the design of the present bridge, if indeed they did not make the bridge possible today where previously every project met failure through one cause or another. But also the establishment of an interstate public cooperation with independent financing powers and the right to levy tolls to repay construction cost was a vital element; all the earlier projects were for construction by private companies as an enterprise for profit.

Earlier sites of bridge projects were at Tenth, 23d, 57th, 59th and 68th Sts. One or two of these contemplated a pier at midstream, but after borings showed great depth of soft ground they were changed to single-span projects. Most of them were for a suspension bridge, but cantilevers and arches were also proposed; spans ranging from 2,500 to nearly 4,000 ft. The most noted of early projects is still active. It is that of the North River Bridge Co., with Gustav Lindenthal as chief engineer since its inception 43 years ago, in which the Pennsylvania R.R. at one time took interest. The present site of this project is at 57th St. Not only is it the only project still active but it has a close relation to the bridge now completed because the engineer of the latter, O. H. Ammann, was long connected with the 57th St. project and took part in working out its suspension bridge designs.

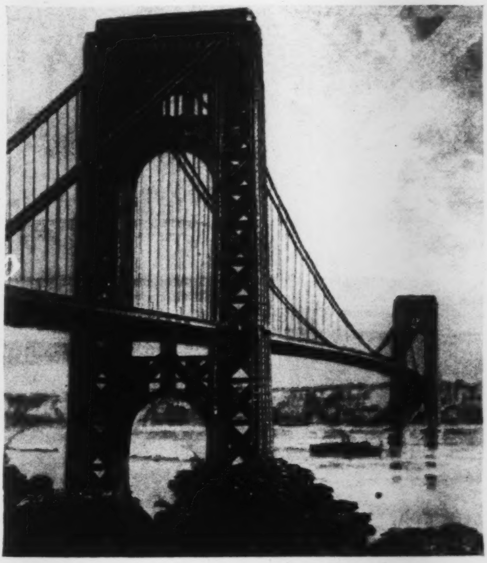
Investigation of the 178th St. site dates back to 1910, when the Interstate Bridge and Tunnel Commission, a joint body of the states of New York and New Jersey, considered the possibility of building there a 1,400-ft. cantilever highway bridge with river piers; a year later, when borings showed that rock could not be reached in the main part of the river width, the scheme was abandoned. It marks quite definitely the time when highway traffic needs had attained such importance as to claim first attention, in contrast to the earlier planning for railway bridges.

But though the Bridge Commission had abandoned its study, yielding to the superior desirability of a highway tunnel 10 miles south—later built, the present Holland Tunnel—study of a bridge at 178th St. was taken up anew in 1923 by O. H. Ammann, then an engineer in private practice, later bridge engineer and now chief engineer of the Port of New York Authority. Using this investigation as a basis, the states of New York and New Jersey in 1925 passed legislation empowering the Port of New York Authority to build a bridge in the general vicinity of Fort Washington Point on the New York side and Fort Lee on the New Jersey side. In 1926 the states made the initial contributions to an eventual \$10,000,000 advance of funds, and directed the Port Authority to proceed with the construction of the bridge. Later the Port Authority issued \$50,000,000 of $4\frac{1}{2}$ per cent bonds, secured by toll revenues to be derived from operation of the bridge.

Basic Site Selection Factors

In determining upon the location of a bridge at 178th St., Manhattan, the geography and topography of the site as well as potential traffic were decisive factors. In so far as geography is concerned, the site has two principle advantages: At the Manhattan end the approaches occupy much less expensive property than would be the case for a bridge farther south, while at the New Jersey end the bridge taps relatively undeveloped but highly desirable suburban residential territory and also affords access to the industrial cities of Paterson and Passaic. A bridge in this location also permits traffic from the north and east to bypass lower Manhattan and, in conjunction with the proposed Tri-Borough bridge over the East River, provides a continuous route from New Jersey to Long Island outside of the congested sections of New York City.

An important consideration in fixing the location of the bridge at 178th St. is the fact that careful studies of pro-



Massive steel towers of unprecedented design suspend the roadway 250 ft. above the waters of the Hudson spective vehicular traffic showed that such a structure would pay since ferries had proved inadequate. In 1926 it was estimated that the number of vehicles crossing the Hudson River in 1930 would be 19,800,000. Actually the recorded number of vehicles crossing the river during 1930 was 25,500,000—nearly 30 per cent greater than the estimate. This same 1926 forecast placed the number of vehicles that would use the Hudson River bridge in 1932 at 8,600,000, increasing in 1946 to 15,000,000. On the basis of the 30 per cent recorded increase in trans-Hudson traffic between 1926 and 1930 a new forecast was made in 1930, which placed the number of vehicles crossing the Hudson River bridge in 1932 at 8,700,000, in 1934 at 10,100,000, and in 1946 at 25,100,000. Based upon the 1926 forecast of traffic and an average toll rate of 50c. per vehicle and 5c. per passenger in vehicles, exclusive of driver, the annual net revenue was estimated to increase from a minimum of $5,250,000 in 1932 and to be sufficient, with a substantial surplus, to meet interest and sinking fund payments during a period of amortization of about 25 years, as well as to refund with interest the amounts advanced by the two states.

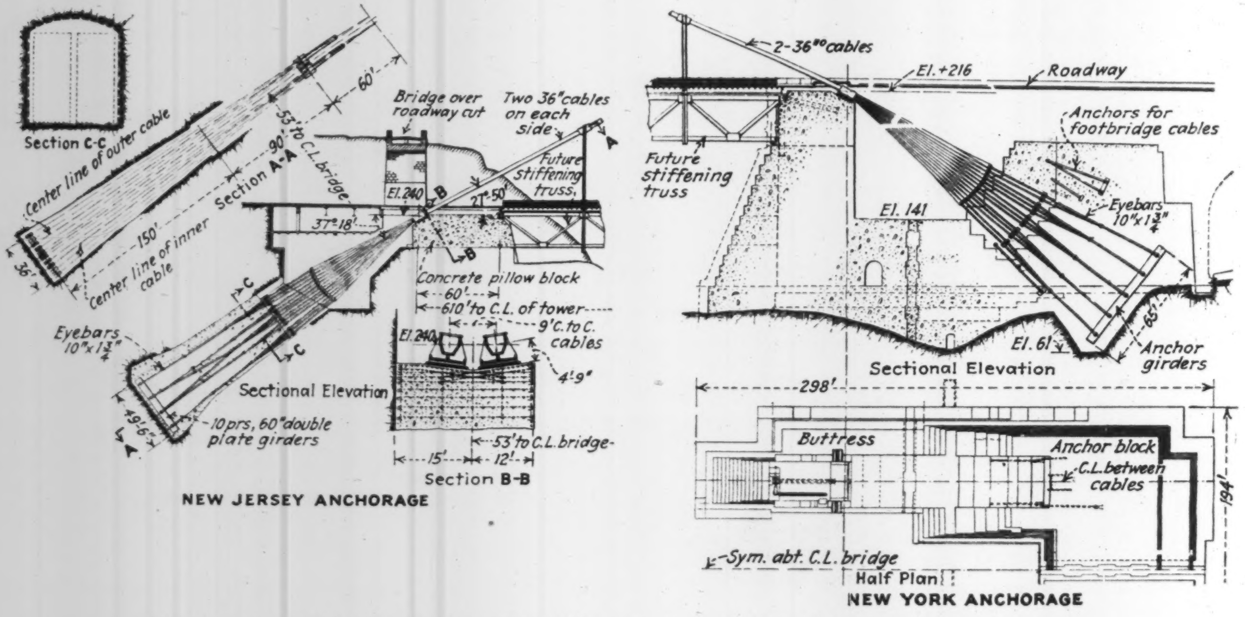
Topography—The topography of the site proved ideal for a long single-span bridge, in fact demanded it. The ground on both sides of the river is high. In New Jersey 500 ft. from the shore line it reaches a height of 280 ft., while in New York about 1,000 ft. from the shore line a height of 200 ft. is attained. Assuming that a 200-ft. clear height at the center was necessary for navigation clearances, the upper roadway of a bridge would be about 240 ft. above the water, which corresponded closely to the topographical conditions.

On the New York side rock is exposed, forming a rocky cape, Fort Washington Point, from which it shelves down steeply toward the navigation channel. On the New Jersey side of the river rock was found at depths of 115 to 170 ft. near the pierhead line, but it also falls off sharply toward the center of the river. It is overlain by material ranging from soft mud to plastic clay. By placing the New Jersey pier about 200 ft. inside the pierhead line, rock could be reached at a maximum depth of 75 ft. and an average depth of 50 ft. This rock was a hard, compact shale and sandstone in strata inclined toward the shore and thus ideal for foundations that needed to be designed with assurance that no tendency to slide toward the river gorge would occur. The Palisades cliffs are a hard diabase, an igneous rock of volcanic origin commonly known as traprock, which would prove ideal for the New Jersey anchorage of a suspension bridge. Tests from cores taken from the site of the New Jersey pier showed variation in strength from 3,000 to 24,000 lb. per sq.in. with a probable average of between 12,000 and 15,000 lb. per sq.in, or more than 30 times the maximum edge pressure of the tower base.

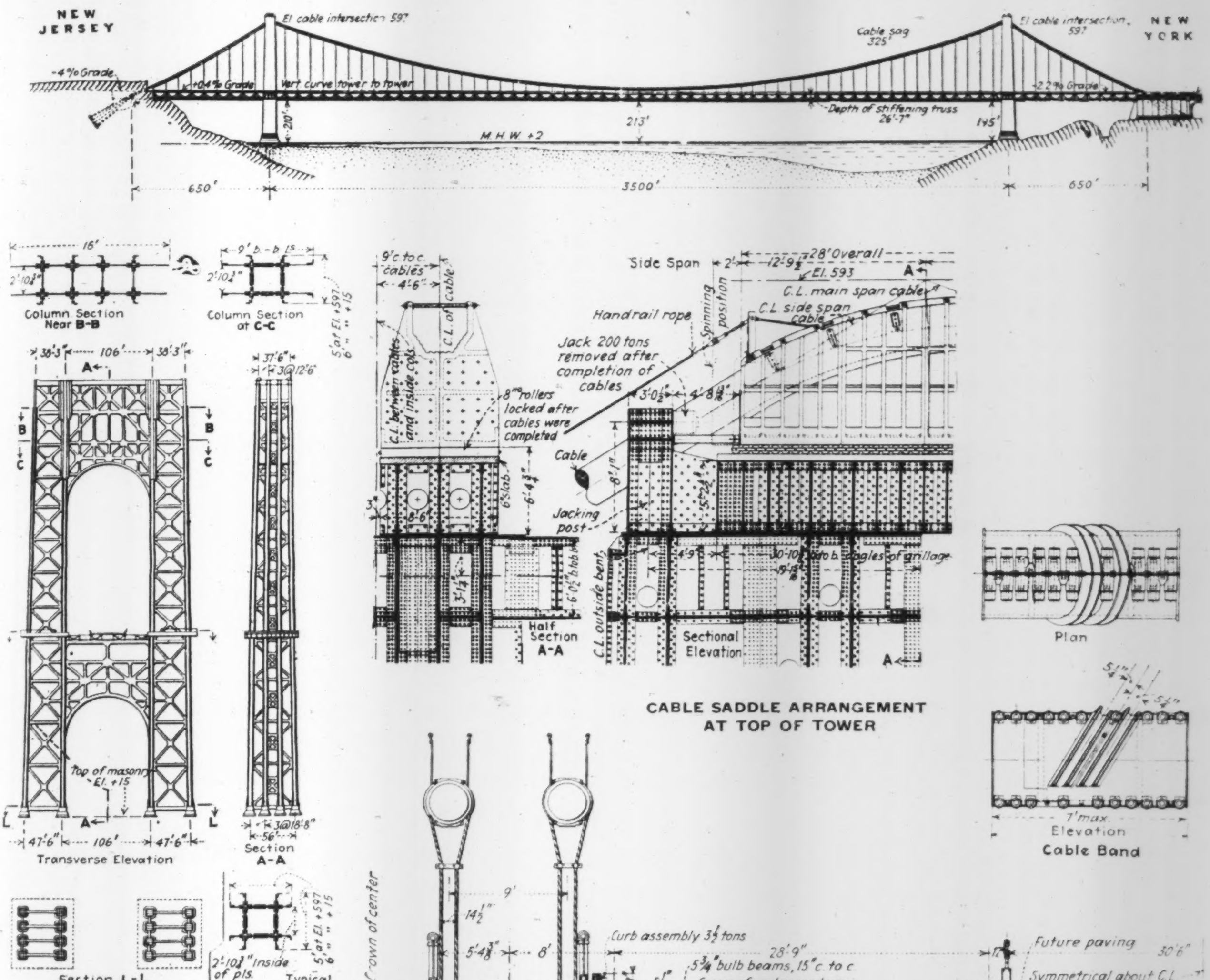
Suspension Design Chosen

Thus topographical and geological conditions indicated clearly the points of support for a suspension bridge and the location of the anchorages. The New York tower was placed on the extreme rocky point of Fort Washington Park, the New Jersey tower 200 ft. back of the pierhead line in order to secure rock at a reasonable depth, thus fixing a main span 3,500 ft. long between supports. The New Jersey anchorage logically was placed in a tunnel in the Palisades some 600 ft. west of the New Jersey tower. High ground in Fort Washington Park offered a symmetrical location for the New York anchorage, but one requiring a gravity structure on top of the ground. Careful study of costs showed that such an anchorage would be cheaper than carrying the side span back to higher ground east of Riverside Drive. In addition the short side span, of practically the same length as the New Jersey side span, preserved the symmetry of the bridge. Although all conditions of site and topography pointed to the use of a suspension bridge, other bridge types were considered, but they were rejected as too costly.

Capacity—Statistics on trans-Hudson traffic indicated


Section C-C
Center line of outer cable
Section A-A
53' to C.L. bridge
60'
90'
150'
36'
Center line of inner cable
Bridge over roadway cut
Two 36" cables on each side
A
Future stiffening truss.
El. 240
B
27°50'
37°18'
B
Concrete pillow block
60'
610' to C.L. of tower
9' C. to C. cables
El. 240
4'9"
C
C
Eyebars 10"x1¾"
Sectional Elevation
49'6"
A
10 prs, 60" double plate girders
53' to C.L. bridge
15'
12'
Section B-B
NEW JERSEY ANCHORAGE
2-36" cables
El. +216
Roadway
Anchors for footbridge cables
Future stiffening truss
El. 141
Eyebars 10"x1¾"
El. 61
65'
Anchor girders
Sectional Elevation
298'
Buttress
Anchor block
C.L. between cables
194'
Sym. abt. C.L. bridge
Half Plan
NEW YORK ANCHORAGE

New Jersey end of bridge is anchored in a deep tunnel in the traprock Palisades, while a 106,000-cu.yd. concrete block forms a gravity anchorage on top of the ground at the New York end


NEW JERSEY
El. cable intersection 597
Cable sag 325'
El. cable intersection 597
NEW YORK
-4% Grade
+0.4% Grade
Vert. curve tower to tower
-2.2% Grade
Depth of stiffening truss 26'-7"
210'
213'
195'
M.H.W. +2
650'
3500'
650'
16'
2'-10½"
Column Section Near B-B
9' b-b
2'-10½"
Column Section at C-C
38'-3"
106'
38'-3"
37'-6"
3@12'-6"
Top of masonry El. +15
47'-6"
106'
47'-6"
Transverse Elevation
56'
3@18'-8"
Section A-A
5' at El. +597
6" " " +15
Section L-L
ARRANGEMENT OF SKELETON TOWERS (First Stage)
2'-10½" Inside of pls.
Typical Column Section
9' c. to c. cables
4'-6"
C.L. of cable
C.L. between cables and inside cols.
8" rollers locked after cables were completed
Half Section A-A
Side Span
28' Overall
12'-9½"
El. 593
Spinning position
Handrail rope
C.L. main span cable
C.L. side span cable
Jack 200 tons removed after completion of cables
Cable
Jacking post
C.L. outside bents
30'-10½" b. to b. angles of grillage
Sectional Elevation
CABLE SADDLE ARRANGEMENT AT TOP OF TOWER
Plan
7' max.
Elevation
Cable Band
16" I-beams 5'-2" c. to c.
60'
5¾" bulb beams 15" c. to c.
Stringers
Wind system
106' c. to c. of chords
Facia girder
Stringers and Bracing Typical Panel
Laterals
Wind Chord Si Steel
Crown of center
Curb assembly 3½ tons
28'-9"
5¾" bulb beams, 15" c. to c.
Crown of center roadway
Future paving
30'-6"
Symmetrical about C.L.
12'-6"
12'-6"
14'
13'
12'
8'
16' clear
29'
40'-3" clear
Future construction
3'-10½"
29'-1½"
40'
106' c. to c. truss
HALF CROSS-SECTION PRESENT AND FUTURE FLOOR STEEL

Principal design elements of 3,500-ft. span George Washington Bridge over Hudson River at New York that traffic crossing the bridge during the first five years of operation could be handled by a four-lane roadway. Doubling this capacity would provide for 25,000,000 vehicles annually, the estimated traffic volume in 1946. This volume of traffic is provided for by a deck 90 ft. wide between curbs. Two 6-ft. sidewalks are provided. The possibility that rapid transit facilities might be required in the future made provision for them a necessity. Consequently the design includes a lower deck beneath the present highway deck to carry four lines of rapid-transit tracks, this lower deck to be added when needed.

Dimensions and makeup of the various parts of the bridge are given in the accompanying drawings. There follows a discussion of the principal elements of the design as they were finally determined.

Cables and Suspension System

The controlling criteria in designing the suspension system were structural simplicity, economy with necessary rigidity, provision of the widest possible competition in materials and erection methods and pleasing appearance. In line with the desire for simplicity, the designers chose a plain, unstiffened cable, supplemented by shallow parallel-chord stiffening trusses. To assure the widest possible competition, complete designs were made utilizing both eyebars and wire cables as the main carrying members. From an esthetic viewpoint the engineers determined upon plain massive towers and a flat catenary, producing a suspended structure light and graceful in appearance but giving the impression of being adequately supported at either end.

Bids were asked on both the eyebar and the wire cable designs, on simultaneous and successive construction of the two pairs (for first and final stages), and on side-by-side and vertically superposed position of the two cables on either side. The lowest bid was for wire cables, placed side by side, and constructed simultaneously. A two cable design had been considered, but was rejected because of the great size of cable required. The cables actually used, being 42 per cent larger than any heretofore built, called forth unusual erection procedure and equipment. (*ENR*, Aug. 14, 1930).

The two cables on either side of the bridge are 9 ft. apart. Each cable contains 26,474 cold-drawn galvanized wires 0.196 in. in diameter, having an ultimate strength of 240,000 lb. per sq.in. For purposes of construction the cable was divided into 61 strands 4½ in. in diameter. The cables are supported on the towers in cast-steel saddles 8½x28 ft. in plan, 10 ft. 9 in. high, weighing 200 tons. Carried on rollers during the spinning operations, these saddles are fixed in position in the completed structure. Standard cast-steel cable bands, carrying two loops (four lines) of suspender ropes are placed around the cables at each panel point. Final wrapping of the cables, accomplished after the floor was in place, was done with soft-annealed double-galvanized steel wire 0.148 in. in diameter.

Floor and Bracing

The floor and wind systems are unusually simple. Because of the extreme dead weight of the structure and its short side spans, insuring inherent rigidity and stability, both windbracing and stiffening truss action become relatively light in suspension bridge design for the first time.

The main upper floor members are deep silicon-steel plate-girder floor beams hung from the suspender ropes. Plate-girder stringers 60 ft. long are framed between the floor beams and carry 16-in. I-section crossbeams about 5 ft. on centers. The roadway slab is placed on top of the crossbeams. The lower deck will be hung from the upper deck by rigid frames. No stiffening truss is used in the present stage of construction, but it will be added below the present roadway when the lower deck is added.

A single wind truss, relatively flexible, is placed in the plane of the upper deck, the top chords of the future stiffening trusses being installed at the present time to form the chords of these wind trusses. The flexibility of this wind truss causes much of the lateral wind load to be transmitted to the towers directly by the cables, which, with such heavy cables as are used on this bridge, is an economical expedient. The design studies indicated, in fact, that the wind truss might have been entirely eliminated except for its effect in preventing local distortions in the floor.

The wind forces on the future lower deck will be transmitted to the wind truss and cables through the rigid frames.

Stiffening Trusses—The future stiffening trusses will by only 29 ft. deep, will be of silicon steel, and will be located wholly below the upper deck. A shallow stiffening truss was selected for appearance and economy and was made possible by the inherent stability of the heavy main span and the rigidity contributed to the structure by the relatively short side spans, whose steeply inclined cables act as rigid backstays. The remarkably shallow depth of the stiffening trusses, 1/120th of the length of the main span, is made apparent by comparison with other suspension bridges: on the Delaware River bridge at Philadelphia, this ratio is 1/63d, on the Manhattan Bridge in New York, 1/60th, on the Bear Mountain Bridge 1/63d and on the Ambassador Bridge at Detroit 1/84th. It is interesting to note that on the proposed Golden Gate bridge, with only a single highway deck, the depth of the stiffening trusses will be only 1/168th of the span.

The stiffening truss designed for the Hudson River bridge is practically flexible in that it exerts little restraint upon the distortions of the unstiffened cables, but is itself forced to deform with the cables. In the initial stage of construction, with no stiffening truss, the floor system is entirely unrestricted vertically except by the cable weight. The use of a flexible system for such loads as rapid-transit cars is a new development, but is justified in the opinion of the designers of the Hudson River bridge by the extreme weight of the main span and the short side spans with almost straight cables.

The governing function of the stiffening system is to prevent excessive gradients in the floor during cable distortion. The trusses were designed to permit safely a gradient of 5 per cent, although the maximum theoretical gradient under a combination of live load and extreme temperature is calculated not to exceed 2.4 per cent. In preliminary studies the stresses in the stiffening trusses were determined by calculating the deflections of the unstiffened cables and the corresponding bending moments in the trusses, subsequently correcting the results slightly for the small stiffening effect that the trusses exert on the cables.

The economy effected by using flexible trusses may be seen by a comparison of weights of stiffening trusses and windbracing in the Hudson River bridge and other bridges. On the Bear Mountain Bridge, having a span of 1,630 ft. and designed for highway traffic only, the

Principal Contracts, George Washington Bridge

Character of Work	Date of Signing	Contractor	Amount
Foundation—New Jersey tower	May 19, 1927	Silas B. Mason, Inc.	$1,060,000
Excavation—New Jersey anchorage and approach east of Hudson Terrace	June 18, 1927	Foley Bros., Inc.	930,000
Steel towers and floor system	Nov. 4 1927	McClintic-Marshall Co.	10,800,000
Cables, suspenders and anchorage steelwork	Nov. 4, 1927	John A. Roeblings Sons Co.	12,200,000
New York anchorage and tower foundation	May 4 1928	Arthur McMullen Co.	1,090,000
New Jersey approach, miscellaneous construction, Hudson Terrace	July 3, 1930	George M. Brewster & Son	323,000
New York approach, main approach ramp	Aug. 7, 1930	Cornell Contracting Corp.	800,000
New York approach, vehicular tunnel, West 178th St.	Aug. 7, 1930	Cornell Contracting Corp.	2,090,000
New York approach, Riverside Drive connection	Oct. 14, 1930	William P. McGarry Co.	1,050,000
New Jersey approach, miscellaneous construction	Feb. 2, 1931	George N. Brewster & Son	480,000
Main span and New York approach, paving, railings and miscellaneous construction	Mar. 20, 1931	Corbetta Concrete Corp.	460,000

average weight of stiffening trusses and wind bracing per foot of bridge is 2,650 lb. The comparable figure for the Hudson River Bridge is 1,110 lb. On the Manhattan Bridge (1,470 ft. span) and the Delaware River bridge (1,750 ft. span) both designed for highway and rapid transit, the average weights of stiffening trusses and wind bracing are 7,200 lb. and 5,730 lb. respectively. The comparable figure for the Hudson River Bridge is only 2,350 lb.

It is estimated that the use of a light flexible stiffening system on the Hudson River Bridge saves about $10,000,000, taking into account resulting savings in cables, towers and anchorages.

Towers

The towers have called forth much favorable and unfavorable comment, largely resulting from opinions on their appearance, which opinions naturally are variable and intensely individualistic. On most previous suspension bridges the towers have been designed as steel frames or bents, fixed at the base and flexible enough to take bending from unequal cable pulls. In the case of the Hudson River Bridge towers it was decided that flexibility was not needed and that their first requirement after load conditions were met was a massiveness of appearance for esthetic reasons. The cables are fixed to the tower tops, but the tower is not subjected to undue bending, since the short side spans reduce to a minimum the tendency of the cable bearings toward longitudinal movement.

Design studies showed that a steel tower and a steel-and-concrete tower compared favorably in cost. The first design was made on the basis of a composite tower in which the steel frame would carry at least the initial dead load of the structure and that the concrete incasement added later would bring the tower up to its ultimate required strength. Controversy arose as to the merit of such a composite tower, so that finally the steel skeleton was made strong enough to carry all loads, and provision was made for concrete incasement later if this proved to be desirable from an esthetic standpoint. This strengthening of the steel towers added about $800,000 to their cost.

The design of the indeterminate steel tower structures was described three years ago by L. S. Moisseiff (*ENR*, May 24, 1928, p. 819). The enormous load concentrations called for a frame of simple parts with clear and certain but not necessarily statically determinate stress action. The vertical reaction on top of each tower is 112,000 tons and the horizontal pull is 110,000 tons for both pairs of cables. Instead of the four-column tower bent with bracing in four planes that has often been used, the Hudson River Bridge tower was made up of four rigidly connected frames each including two pairs of braced posts connected by arched portal bracing below the floor level and at the top. Cables are disposed over the inside columns of the bents, one pair over each column, but the vertical load is distributed to all four columns of each bent by means of a heavy top girder and transverse bracing throughout the height of the tower in such a manner that exact proportioning of all column sections was possible. The only excess metal in the tower is in the upper portions of the exterior columns. Placing the cables over the interior columns instead of midway between the interior and exterior columns of the tower bents is one of the unique features of the design. If the latter alternative had been followed, the central planes of the cables would have been 144 ft. apart, which would have required floor beams of the same length. This would have occasioned a very considerable additional cost, about $2,800,000, as compared with the adopted design of floor beams 106 ft. long, made possible by locating the cables directly on the inner columns. The adopted design saved about 12,000 tons of floor-beam material, while the saving in the tower itself by making its symmetrical by centering the cables would have been less than $100,000.

The towers as built are 566 ft. high from foundation to top of steelwork. Each leg at the base is 47½ ft. wide and 56 ft. long center to center of columns. Typical column sections are shown on the accompanying drawing. The maximum section occurs on the interior line of columns in the top panel under the cables and contains 1,296 sq.in. of metal. The steel area of each column in the bottom panel of the tower is about 717 sq.in.

The cost of the bridge, its approaches and the highway connections as now built, with the construction work yet to be done in the near future (which includes the completion of the New York anchorage and the tunnel approach in 178th Street) and inclusive of right-of-way, interest during construction and cost of financing, will be within the $60,000,000 estimate made at the time the bridge was financed.

The cost of operation, inclusive of toll collection, policing and maintenance, is estimated at $350,000 per annum.

The George Washington Bridge was designed by the engineering department of the Port of New York Authority, of which O. H. Ammann is chief engineer, Edward W. Stearns assistant chief engineer, Allston Dana engineer of design, M. B. Case engineer of construction, Aksel Andersen assistant engineer of design, W. E. Cuenot chief draftsman, H. J. Baker engineer of steel inspection, and A. W. Munsell engineer of masonry inspection. R. Hoppen, Jr., and H. R. Seely were resident engineers.

The chief engineer also had the advice of the following consulting engineers: William H. Burr, the late Gen. George W. Goethals, Leon S. Moisseiff (on design) Daniel E. Moran (on foundations), Ole Singstad (on vehicular tunnel approach), Lewis B. Stillwell (on electric installations), and Joseph B. Strauss. Gustav Lindenthal, consulting engineer, rendered special advice on design questions, and Prof. Charles P. Berkey, acted as consulting geologist. Cass Gilbert was consulting architect.

Erecting Towers and Floor Steel on the Hudson River Bridge

Structural steel placed in record time under carefully organized erection procedure — Towers erected by platform travelers moving upward between tower legs and carrying two derricks, each operated by a 300-hp., seven-drum hoisting engine —A-frame travelers operating on the deck each way from each tower erected floor steel

By AUSTIN S. HALTEMAN
Erection Department, McClintic-Marshall Corp.

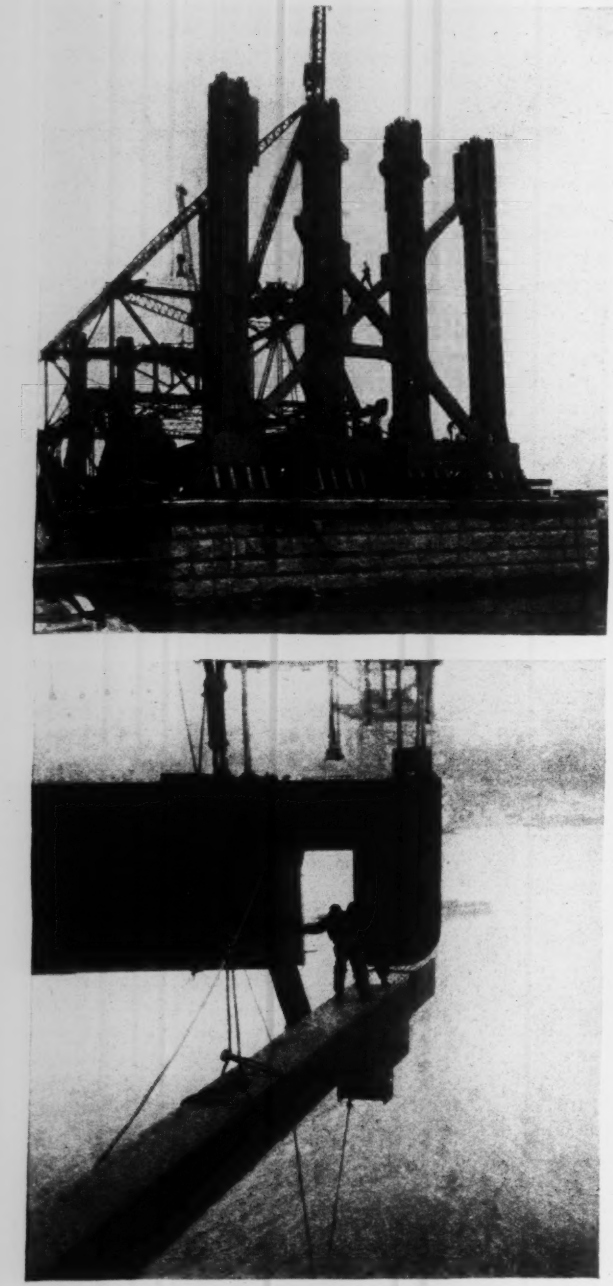


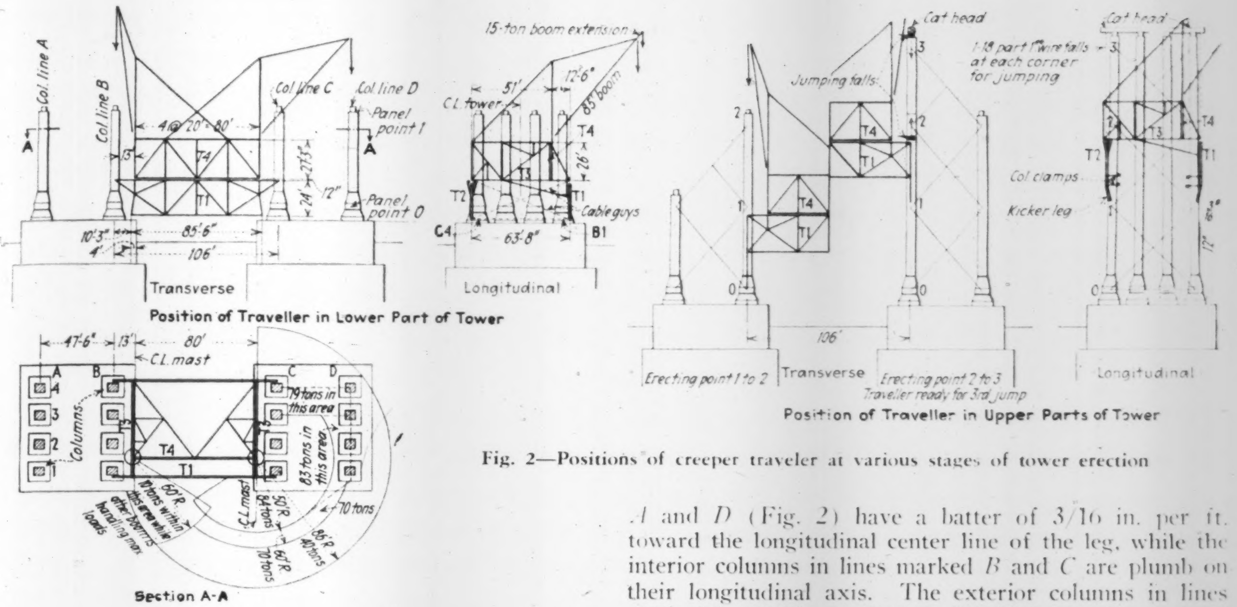
Fig. 1—Of the 60,000 tons of steel in the Hudson River bridge 40,000 tons was placed in the two towers in picks weighing from 37 to 80 tons each (top). Principal floor members were 62-ton floor beams and 12-ton wind chords (bottom)

ERECTION of fabricated structural steel on the Hudson River bridge was an operation that both preceded and followed the spinning of the cables. Thus the two towers had to be completed before cable spinning could start, and the floor steel could not be placed until the cable work was finished. The structural steel erector, therefore, had two separate jobs to perform, each not only different from the other but separated from it by a considerable time interval and capable of being carried out by two different erection gangs if need be. In describing the erection work it is logically considered as two distinct operations—tower erection and floor-steel erection—and it is so considered here.

Some elements of the preliminary planning, such as provision of steel-receiving facilities, establishment of field-office buildings, blacksmith shops, supply depots, etc., took into account the needs of both steel erection jobs; but for the most part this planning was directed toward setting up the tower-erection system, for this was the key operation in the time schedule, its completion governing the start of the cable spinning.

The most important of the operations preliminary to steel erection was the provision of facilities for receiving steel at the site. All steel for the job was shipped from the fabricating shops to ground storage at the New Jersey terminals of the railroads several miles down the river. As required by the erection forces, this steel was loaded on railroad cars, in turn loaded on a car float and towed to the bridge.

The New Jersey tower is about 100 ft. off shore in water deep enough to permit the car floats to be moored. Steel for the west half of the bridge, therefore, could be picked directly from the cars upon which it was received and placed in the tower. The New York tower, however, is on land, about 100 ft. in from the shore line. Here it was necessary to provide means for transferring the steel from the floats to the base of the tower. Docking facilities were most important. At the site, however, a sloping rock bottom was encountered, with rock at elevation + 15 about 50 ft. in from the shore line and at elevation — 140 at 150 ft. out from shore. After


Col. line A
Col. line B
Col. line C
Col. line D
Panel point 1
Panel point 0
A
A
4 @ 20' = 80'
13'
T4
T1
27'3"
24'
12"
10'3"
4'
85'6"
106'
Transverse
15-ton boom extension
51'
12'6"
85' boom
C.L. tower
T4
T3
T2
T1
26'
Cable guys
C4
B1
63'8"
Longitudinal
47'6"
13'
80'
C.L. mast
A
B
C
D
4
3
2
1
Columns
T3
T4
T1
19 tons in this area
83 tons in this area
60' R. 10 tons within this area while other boom is handling max. loads
C.L. mast
50' R. 84 tons
67' R. 70 tons
86' R. 40 tons
70 tons
Cat head
Jumping falls
1-18 part 1" wire falls at each corner for jumping
3
2
1
0
T4
T1
106'
Erecting point 1 to 2
Transverse
Erecting point 2 to 3 Traveller ready for 3rd jump
Cat head
T4
T3
T2
T1
Col. clamps
Kicker leg
12' 16 3/8"
Longitudinal

Position of Traveller in Lower Part of Tower

Section A-A

Position of Traveller in Upper Parts of Tower

Fig. 2—Positions of creeper traveler at various stages of tower erection

careful studies of wharf designs a rock-filled crib type was selected. Five timber cribs were built, floored over with heavy planks and sheathed on the river side. These cribs were then tied back to the tower foundations and to anchors placed in the rock bank, in order to keep them from sliding down the steeply shelving rock. Rockfilling was placed in the cribs to a height about 3 ft. above high tide. This wharf, placed in May, 1928, was removed in good condition in July, 1931.

A stiff-leg derrick on the wharf unloaded the steel and passed it back to where the tower creeper derricks could reach it.

Office facilities were set up at the New York end of the bridge for general supervision of the work. However, actual erection of the two towers and to a large degree of the two halves of the floor steel was carried out as two separate jobs, each with its supervisory officers and supply depots on its own side of the river.

Tower Erection

The form and general design of the towers of the Hudson River bridge were radically different from any towers of previous suspension bridges, and consequently they called for an entirely new approach to the erection problem. Each tower has two legs, in each of which are eight columns arranged in rectangular plan and braced by struts at twelve levels in their height (less cable saddles) of 566 ft. and by heavy diagonal cross-bracing in each panel between the struts. The two legs thus formed are tied together below the roadway level and at the top by arch portal bracing. The panels vary in length from 56 ft. 6½ in. at the bottom to 38 ft. 9½ in. at the top. Each tower leg is 47½ x 56 ft. in plan, center to center of columns, while the two legs are 106 ft. apart, center to center of inside columns.

In addition to the fact that each tower contains two legs a considerable distance apart, two other characteristics of the design exercised an important bearing on the erection procedure and equipment. These characteristics were the batter of some of the columns and the extreme weight of some of the erection pieces near the top of the tower. The exterior columns in lines marked *A* and *D* (Fig. 2) have a batter of 3/16 in. per ft. toward the longitudinal center line of the leg, while the interior columns in lines marked *B* and *C* are plumb on their longitudinal axis. The exterior columns in lines marked 1 and 4 have a batter of 3/16 in. per foot toward the transverse center line, while the interior columns in lines 2 and 3 have a batter of 1/16 in. per foot toward the transverse center line. Erection equipment had to be designed to accommodate these battered columns, and it had to be of large capacity.

The inside columns in lines *B* and *C* are made wider at the top so as to support the cable saddle grillages adequately. Due to this design the *B* and *C* column sections, although growing shorter toward the top do not become much lighter, the erection piece between panel points 9 and 10 weighing 78 tons, while the heaviest erection pieces in the tower (those in the bottom panel of columns in lines *B* and *C*) weighed 80 tons. Columns

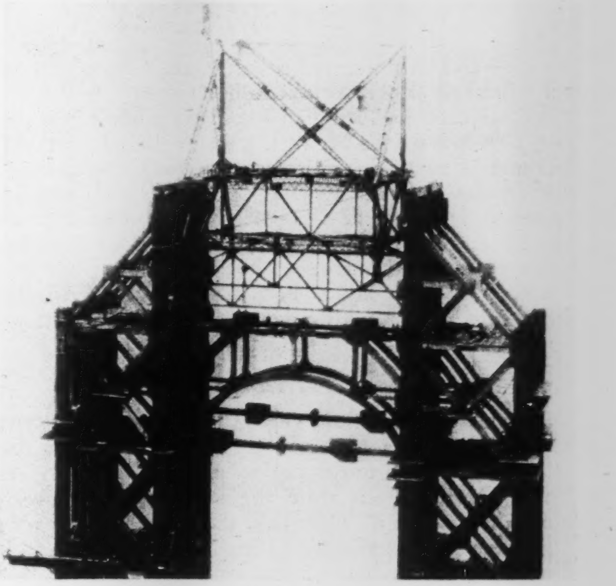


Fig. 3—Creeper traveler spanning between tower legs erected towers

Creeper has just been jumped. After erecting portal steel, as shown, derricks will complete outside half of tower panel below them and inside half of panel beside them before being jumped again.

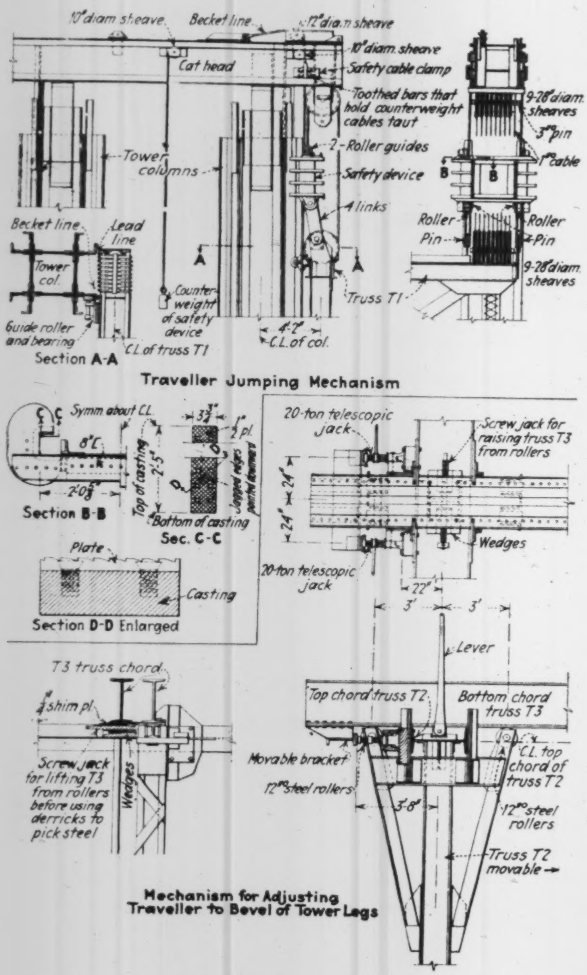

10" diam sheave
Becket line
12" diam sheave
10" diam. sheave
Cat head
Safety cable clamp
Toothed bars that hold counterweight cables taut
2-Roller guides
Safety device
4 links
Tower columns
9-28" diam. sheaves
3" pin
1" cable
B
B
Roller
Pin
Roller
Pin
9-28" diam. sheaves
A
A
Truss T1
Becket line
Lead line
Tower col.
Guide roller and bearing
Counterweight of safety device
4'-2"
C.L. of col.
C.L. of truss T1
Section A-A
Traveller Jumping Mechanism
Symm about CL
8" [
2'-0 5/8"
Section B-B
3 3/4"
1/2" pl.
Top of casting
2'-5"
Jagged edges pointed downward
Bottom of casting
Sec. C-C
Plate
Casting
Section D-D Enlarged
20-ton telescopic jack
Screw jack for raising truss T3 from rollers
24"
24"
Wedges
20-ton telescopic jack
22"
3'
3'
Lever
T3 truss chord
1/4" shim pl.
Screw jack for lifting T3 from rollers before using derricks to pick steel
Wedges
Top chord truss T2
Bottom chord truss T3
Movable bracket
12" steel rollers
C.L. top chord of truss T2
3'-8"
12" steel rollers
Truss T2 movable →
Mechanism for Adjusting Traveller to Bevel of Tower Legs

Fig. 4—Mechanical assemblies used in operating erection creeper on Hudson River bridge towers

in lines *A* and *D* presented a maximum 67-ton section and a minimum 37-ton section to be erected.

The heaviest panel length of column occurred in the *B* and *C* column lines between panel points 10 and 11 and 11 and 12, and weighed 102 and 150 tons, respectively. However, the columns between panel points 10 and 11 were shipped in two 51-ton pieces, and between panel points 11 and 12 in three 50-ton sections, so that the erection picks were not excessive. These top sections of columns in the *B* and *C* lines were spliced vertically, giving a final section with six longitudinal and six transverse webs.

Determining Erection Procedure

Numerous considerations caused the conventional type of single-boom tower creeper to be discarded from the erection planning as uneconomical and too slow. Some of these considerations were the wide spread between column lines *B* and *C*, (106 ft.), the considerable width of the tower longitudinally as well as the total width transversely, the absence of any struts between the two legs except at the portals, and the large number of lifts to be made.

The traveler adopted was made up of two stiff-leg derricks mounted on a bridge or platform that spanned the 106 ft. between the *B* and *C* column lines. Each derrick had a tower leg to build and was operated independently of the other, except that maximum loads could not be handled by both derricks at the same time. The use of two derricks more than halved the erection time because the 85-ft. booms used were much shorter, and therefore faster, than the boom that would have been required on a single-derrick creeper. Competition between the two derrick gangs also tended toward speed in erection, for a panel on both legs had to be completed before the traveler could be jumped.

Traveler Design

The two main traveler trusses marked *T*1 and *T*2 (Fig. 2), were supported on tower columns *B*1, *C*1, *B*4 and *C*4 by means of four kicker legs or toggles, except during erection of the bottom panel when the toggles and the lower corners of the trusses had to be omitted because they fouled the column pedestals. As soon as this bottom panel was passed, however, the kicker legs were attached, each leg resting on a bracket made from one of the regular column diaphragms, reinforced and stiffened. The horizontal thrust of the kicker legs was taken care of by clamping the *Uo* points of trusses *T*1 and *T*2 to the columns.

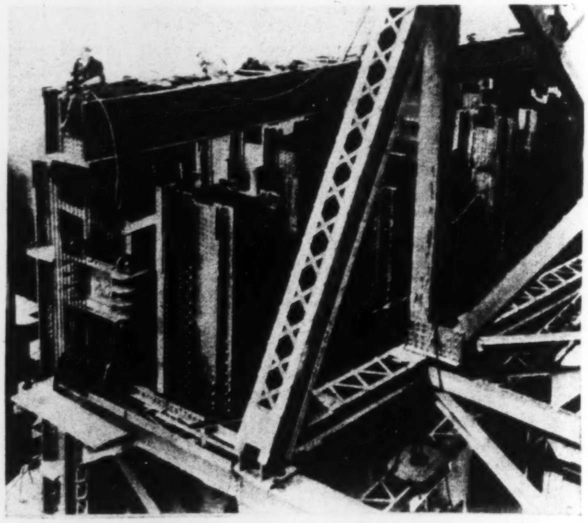


Fig. 5—Tower creeper was jumped by means of 18-part falls attached at each corner of the creeper and to a "cat head" beam placed over the tops of the erected columns

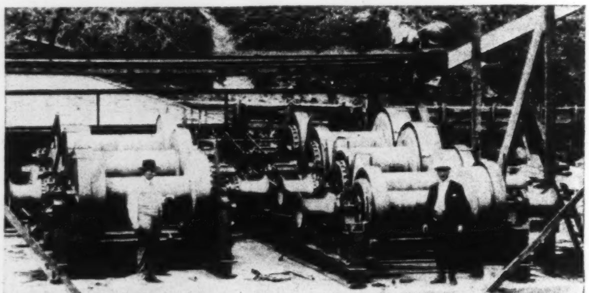


Fig. 6—Seven-drum electric hoisting engines operated each derrick on the tower creepers

The masts of the derricks were located 12½ ft. behind the river truss *T*1 and 13 ft. from the center line of the *B* and *C* columns, both to give the minimum reach for picking and erecting the columns and to provide clearance between the 10 ft. bullwheel and the columns. The top chords of truss *T*4 and the two trusses *T*3 served as sills for the derricks.

It will be noticed from Figs. 2 and 4 that the river end of truss *T*3 rested on and was rigidly attached to truss *T*1, while the land end of this truss rested on *T*2 through rollers. The latter allowed the trusses *T*1 and *T*2 to approach each other as they traveled up the tower, thus adjusting for the batter of the columns in lines 1 and 4. Two 20-ton telescoping jacks were installed to assure this adjustment, although they did not prove to be necessary as the trusses adjusted themselves to the batter automatically. After each traveler jump, truss *T*3 was jacked off the rollers before the derrick picked any steel; the screw jack and wedges by means of which this latter operation was accomplished are shown in Fig. 4.

Each traveler weighed 320 tons and was jumped by means of 18-part falls of 1-in.-diameter steel cable, one set at each corner of the traveler. The lower block was built into the ends of the top chords of trusses *T*1 and *T*2, while the upper block was placed in a "cat head," a temporary beam supported on the top of the columns in lines *B* and *C*. After the traveler had been jumped, these cat heads were removed and hung off on the outside of the tower until the next traveler jump, one panel above.

Four safety devices were installed in the jumping mechanism, one at each corner, consisting of an assembly of wedges that caused heavy casting members to be clamped onto the columns if the travelers started dropping due to breakage of the jumping falls. This clamping action was made more certain by attaching roughened steel plates to the faces of the castings that surrounded the tower columns. The jagged edges of these plates were pointed downward so they would bite into the column steel. The safety device was held from falling with the traveler by a counterweight whose cable passed over sheaves attached to the cat head. Details of these safety devices are shown in Fig. 4. Fortunately, no difficulty was experienced in jumping the travelers so that there was no occasion for testing the efficiency of the safety mechanism.

Method of Traveler Operation

Each traveler was operated by two seven-drum engine units, one for each derrick. Of these seven drums two were used for the main load falls, one for the auxiliary load falls, two for the boom falls and two for the jumping falls.

Both ends of the load falls and of the boom falls were brought to the engine, and both ends were pulled simultaneously. This decreased friction losses and therefore reduced the lead-line pull, halved the time required for lifts and did not necessitate as large individual drum capacity as would the more usual method of reeving.

Each seven-drum unit was powered by two 150-hp. 440-volt three-phase, alternating-current motors. These motors could be used independently or, by throwing one lever, could be coupled together to deliver the full 300 hp. on one pair of drums. The two drums pulling on the two leads for the load falls were coupled together so that both went ahead or slacked off simultaneously, thus giving at all times two six-part falls instead of one twelve-part fall. A similar coupling was provided for the two drums carrying the boom-falls leads.

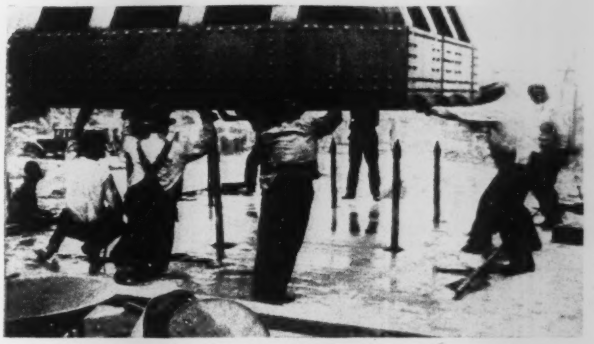


Fig. 7—In erecting column pedestals steel pads (beside screed rail in right foreground) shimmed to exact elevation were used to assure accurate setting of pedestal on mortar bed

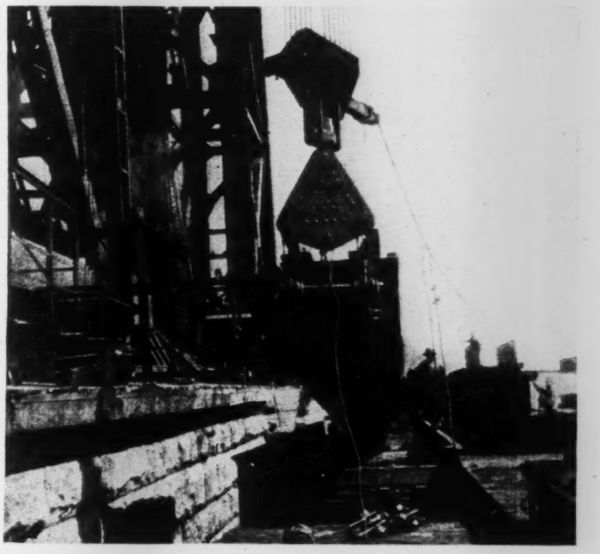


Fig. 8—Special hitches were used for unloading and hoisting the tower column sections

The four hoisting engines were located on the ground 150 ft. landward from the center line of the towers. They were 300-hp. seven-drum engines built for the job and gave entire satisfaction. They were probably the largest portable hoisting engines ever used on a construction job, each engine weighing 75 tons.

Signaling System

Over each drum or pair of drums there were two lights, one red and one white, controlled by the signal man on the traveler through a push-button control. There was also one bell to an engine unit, controlled from the push-button box. A white light signaled the engineer to go ahead and a red light to lower. If the signal system failed, the lights went out and the engineer stopped his engine, so that no damage resulted. This system proved entirely satisfactory, and results were even better than where the engineer can see the load or get his signals visually from the signal man. The derricks were swung by means of small electrically-operated swinging engines located on the traveler itself.

Erection Procedure

The first piece erected were the column pedestals. These were large structural units, 13 ft. 9 in. square and weighing 55 tons, and had to be set with extreme accu-

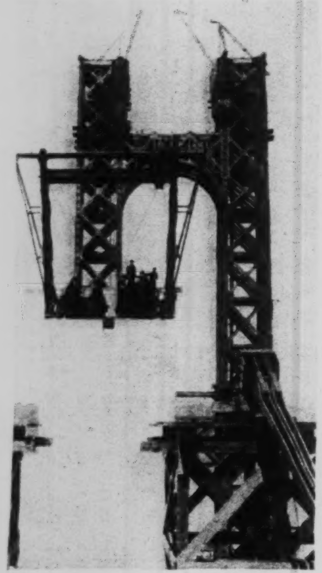


Fig. 9—At top of tower, creeper derricks were moved onto tower legs, creeper trusses removed and the top portal bracing set to complete the tower erection

In foreground are New York anchor block and eyebar anchors for footwalk cables.

racy. An ingenious method of setting them to exact position was devised. The pedestal was first set in place on steel pads on the foundation pier, as shown in Fig. 7, and bronze shims were inserted until it was level and at the correct elevation. The pedestal was then removed and a bed of stiff 1:1 mortar laid down and struck off $\frac{1}{8}$ in. high by means of a special screed bar slid along rails accurately set on either side of the pedestal location. The pedestal was then lowered over the anchor bolts, as shown in Fig. 7. If it did not rest on the steel pads under its own weight, another pedestal was placed on top, which forced it down. This method proved to be much quicker and cheaper than bush-hammering or grinding the piers, as has been done on some bridge jobs. It is also believed that better bearing was secured than is obtainable by any other method. One pedestal was wedged up and pulled off after the preliminary set of mortar, and the bearing was found to be perfect. After the mortar had set up, the steel pads and bronze shims were removed and grout was rammed into the space they had occupied.

Tower Steel Erection—The column sections to be lifted varied in weight from 37 to 80 tons. They had riveted to them all of the connection gussets for the struts and diagonals, so that these latter members could be merely lifted into place. In general, column splice material was riveted to the top of the column section, although splice material for the wing angles was received bolted. Erection, therefore, consisted in the placing of large and heavy, but completely assembled, units.

The erection procedure may be briefly summarized as follows: In their first position, with the traveler spanning between the two foundation piers, the derricks placed the column pedestals, the entire first panel of each tower leg and the inside columns (*B* and *C* lines) of the second panel. The traveler was then raised until the derricks were at the elevation of the second panel point, from which position the outside columns of the second panel, the inside columns of the third panel, the remaining half of the bracing in the second panel and half of the bracing in the third panel was erected. On the next raise this procedure was repeated.

Special hitches were used for picking and setting the columns and heavy portal members, the type of hitch depending upon the length and weight of the section. Hitches for upending the columns were also utilized. The columns were unloaded flat, after which the hitch was attached to the upper end. A triangle balance beam, hung from the 12-part main-load block of the traveler derrick, was connected to the hitch by wire cable grommets, the column upended and hoisted. When in approximate position in the splice and within 1 in. of bearing, all dirt and paint that had been scraped off the sides of the member were blown out by compressed air. The column was then dropped into final position, and the splice bolted and pinned. It required 17 min. to raise the last column section from the ground to the top of the tower.

There were 475,000 rivets, weighing 325 tons, in each tower. Special scaffolds, used for riveting the column splices on the outside, utilized a 2-in. plank roof to protect the riveters; the scaffolds were also inclosed in a hand-railing. These scaffolds were suspended from the column above, their position being adjustable for about 60 ft. vertically by means of winches, which were hoisted every panel by the derrick. Oil and electric forges were tried, but the most satisfactory was the coal forge with an extra large pan. The tower legs were floored over at each panel point with 4-in. plank immediately after erection, and this floor was not removed until all rivets in the vicinity were driven. This not only provided a working platform but gave protection to all men working below the raising gangs.

Tower erection work was suspended when steel had been erected to panel point 10, in order to take comparative elevations on the columns. Small differences in elevations (about 3/16 in.) were adjusted by the shop in fabricating the last two panels. Erection was not resumed until the next spring because of the bad weather

With the tower legs completely erected and the traveler at the top of the tower, the derricks were moved outward onto the tower legs. From this position they took down the traveler and erected the top portal. In order to maintain the correct distance between the column lines *B* and *C*, gage struts were used at panel points 2, 4, 6, and 8 on column lines 1 and 4 until enough of the portal had been built to permit their removal.

As a final operation, one of the derricks was moved so that its mast was on the river column line 4 and on the longitudinal center line of the bridge. The boom was lengthened to 105 ft., and this derrick then took down the second derrick, erected grillage girders for the cable saddles, placed the saddles themselves and erected the construction tower and crane runway (see cable-spinning article, *ENR*, Aug. 14, 1930) used for handling the main cable strands. This derrick also raised and placed in position the thirty-six $2\frac{3}{4}$-in.-diameter ropes used to support the footwalk required in spinning the cables.

The shop work on the towers was excellent, no serious difficulty in making a connection or getting a joint in bearing being experienced. Also, there were no drawing room errors. During the entire course of the work there was no accident that could be charged to failure of equipment or supervision. The amount of money spent on special equipment, derricks and engines for the erection of steel on this job was very heavy, but the lack of accidents and the speed of erection proved that the money was well spent.

The first steel was set in the New Jersey tower on June 25, 1928, and in the New York tower on August 8, 1928. The towers were turned over to the cable contractor on June 20, 1929.

Floor System Steelwork

Roadway steel to be erected on the Hudson River bridge comprised 19,188 tons, made up of 8,645 tons of carbon steel, 8,131 tons of silicon steel, 2,341 tons of beams and tierods in the roadway slab, 68 tons of cast steel and cast iron and 3 tons of bronze. This steelwork differs from that used on any previous suspension bridge, in that there is, under the first stage of construction, no stiffening truss. The present floor steel includes the upper chord of the stiffening truss that will be necessary when a proposed lower deck is added sometime in the future, but it is now utilized as a wind chord for the existing floor system.

The component parts of the floor system are indicated in the plate on p. 643. The principal members is a built-up plate-girder floor beam about 10 ft. deep, attached at each end to two groups of four $2\frac{7}{8}$-in. wire rope hangers. The floor beams are spaced on 60-ft. centers by means of the wind chords, set in 6 ft. from the ends of the floor beams and entered from the bottom. Eight lines of plate-girder stringers about $5\frac{1}{2}$ ft. deep frame into the floor beams below the top flange and carry 16-in. I-beam cross-members on 5 ft. 2-in. centers. On top of these cross-beams $5\frac{3}{4}$-in. bulb beams are placed longitudinally, spaced 15 in. apart. These bulb beams are concreted into the $7\frac{1}{2}$-in. concrete floor slab. Two lines of built-up steel curbs divide the 90-ft. roadway into three lanes, of which only the outer two, each 28 ft. 9 in. wide, have been paved at the present time.

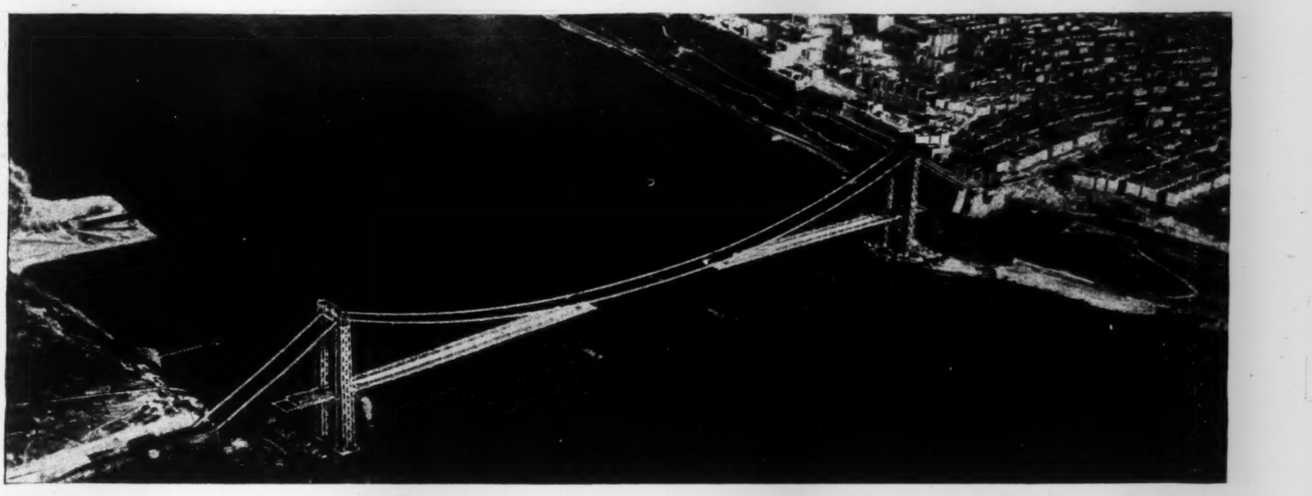


Fig. 10—Floor steel was erected each way from each tower by deck travelers

Floor Steel Travelers

Rapid erection was required by the contract, and the speed with which the main span floor could be erected was the determining factor. Erection of the floor was carried on simultaneously at four different points, travelers working both ways from each tower. Due to the large size of the cables, the entire steel deck could be erected by the travelers as they moved out, without excessive cable distortion. On most suspension bridges where the travelers have operated on the deck, it has been necessary to make two, and sometimes three, passes to complete the floor steel; otherwise the excessive local deflections would make assembly of stringer floor-beam connections and chord splices very difficult.

Main Span—Each of the main span travelers was, in reality, two A-frame derricks with cable backstays, coupled together. By using two derricks to pick the only heavy lift, the $62\frac{1}{2}$-ton main floor beams, lighter, shorter and faster booms could be used and a smaller number of parts of line was required in the main load falls than if a single extra large traveler had been used. As a consequence, the erection time was reduced more than half. After a floor beam had been set, the two A-frame travelers operated independently, each filling in half of the panel. By having two raising gangs, competition was created, and greater speed of erection obtained. If one gang finished its half before the other, it helped fill in the other half, so that the two travelers could be moved as a unit. A-frame cable-backstay travelers are easily adjusted to compensate for a change in grade, it being necessary merely to move the sheave at the end of the backstay to a different pin hole in the link plates (Fig. 13).

All of the A-frame travelers had been previously used on other jobs and required some rebuilding for the Hudson River bridge work. The travelers for the New York half of the main span had been used to erect the Port Authority's Outerbridge Crossing between Staten Island and New Jersey and on the Mt. Hope Bay bridge approaches. For use on this job the tops of the two A-frames were tied together with steel cable, and side guys or "quarter falls" were used on the north side of the north traveler and on the south side of the south traveler. The shoes at the bottom of the quarter falls were bolted to the top flange of a floor beam, these being the only tie-downs required at the front of the traveler. Although the engine provided sufficient counterweight to take care of the uplift, a rear tie-down was provided as an additional safety factor, and to take out vibration. The two front sills were fastened together with a removable ling that transferred shear only.

The four-drum, 150-hp., 440-volt, three-phase alternating current electric engines used were part of the seven-drum units that erected the towers. Of these four drums, one was utilized for the main load falls, one for the auxiliary load falls, one for the boom falls, and one for the traveler moving falls. The booms were swung by point lines, worked by small electrically operated swinging engines located on the traveler.

The travelers for the New Jersey half of the main span had been used to erect the Cooper River bridge at Charlestown, S. C. The A-frames of these travelers, having only an 18-ft. spread at the bottom, were not very stable, so an additional side brace leg was added. Like the travelers on the New York side of the river, the front sills were linked together for shear only.

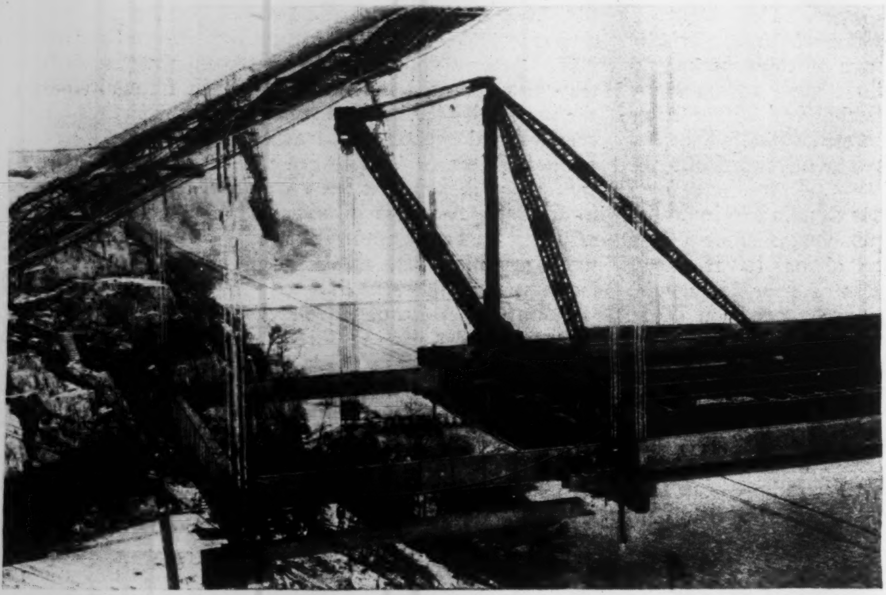


Fig. 11—Side-span floor steel was erected by stiff-leg derrick travelers operated from the ground by one of the hoisting engines previously used on the tower creeper

Two 150-hp., three-speed, three-drum gasoline engines were used, with one drum operating the main load falls, one drum the auxiliary load falls, and the third drum the boom falls. Gasoline engines were preferred to electric engines because of the great cost of the heavy conductors required on the latter and the expense of laying and removing these conductors. Electric engines were used on one side of the river because the erector did not own additional gasoline engines powerful enough to work at a fair speed, and the purchase of such engines was not deemed economical. The New York side was chosen for the electric engines because of the cheaper power rate. The New Jersey main-span traveler was moved by manila rope falls operated from the niggerheads. The engine had a swinger attachment that swung the boom by means of point lines.

The side-span travelers were alike, each being made out of one of the stiff-leg derricks from the tower travelers. A single-boom rig was used on the side span because, for the comparatively short spans, it would not be economical to make a traveler from other derricks that the erector owned, and pay the freight to and from the Hudson River bridge; besides, the tower stiff-leg derricks had been stored on the job and were thus available. With the main span partly erected before side-span erection was begun, there was no appreciable change in grade to be adjusted for, and so the stiff-leg derricks were perfectly satisfactory for side-span erection.

Side-Span Travelers

The engine used for each side-span traveler was one of the tower-traveler engines. These engines were left on the ground at the rear of the towers, since the leads did not need to be excessively long (only 550 ft.) to serve the side spans adequately. Special sheaves were provided to support the cable above the floor of the span, and no trouble was experienced in overhauling boom or load falls. A swinging engine mounted on the traveler swung the boom by means of a bull wheel.

Like the tower steel, the floor steel was shipped from the shop where it was fabricated to ground storage at the New Jersey terminals of the railroads. From there it was brought to the job as required by the erector, being loaded on railroad cars, in turn placed on a car float. Railroad tugs delivered the car floats to the tower foundation on the New Jersey side and to the erector's wharf on the New York side of the river.

When required for main-span erection, the car float was towed out and moored to a barge that was anchored directly under the panel being erected. The erection travelers on the bridge deck transferred the steel direct from the car float to its position in the bridge.

Although these barges carried lights and were left in the river at all times, it was not permissible to have the car floats moored to them overnight; accordingly, the car floats had to be towed out every morning and returned to shore in the evening. Four anchors were used on each barge, and the position of the barge was adjustable by slacking off and taking up on the anchor lines. When the limit of motion had been reached by working the anchor lines, the anchors were shifted by tugs.

Car floats carrying steel for the side spans were moored to the wharf on the New York side and to the tower foundation on the New Jersey side, from which points steel was raised to the bridge deck by a stiff-leg derrick located directly above. The steel was then loaded on push cars and trucked back to the side-span travelers, using the bulb beams as rails.

The floor beams were erected first, each hung from eight suspender ropes. Then followed in order the wind chords, stringers, bracing, cross-beams, bulb beams and

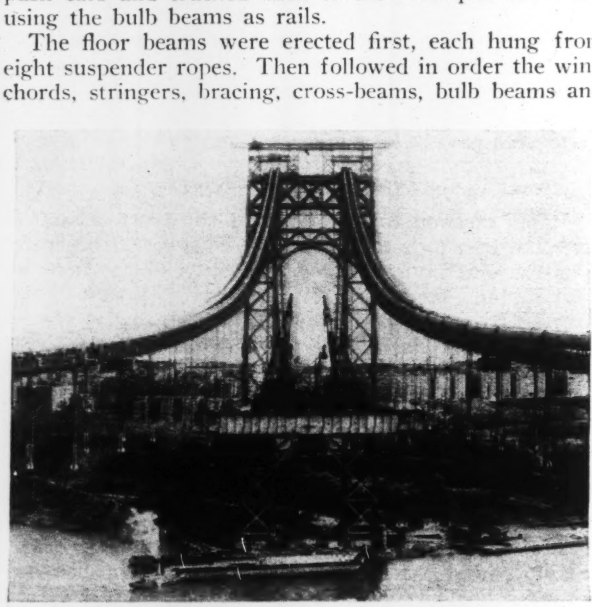


Fig. 12—Two A-frame derricks were used to lift the 62-ton floor beams, and then each derrick working independently filled in half of the panel of floor steel

tie rods. The main load falls were used only on the 62½-ton floor beams and the 12½-ton wind chords, all other steel being set with a two-part auxiliary falls. The wind chords could have been raised with the auxiliary falls, but the main falls were used to get the delicacy of motion required to enter the wind chord into the floor beam (Fig. 1) and make the connection.

On the main span a 12 x 12-in. timber 62 ft. long was used as a spacing strut and tie to keep the floor beam exactly 60 ft. out until the wind chord connection could be made. This timber was also used as a footwalk by the workers. For the side spans this strut was not necessary, since the floor beam was not exposed to heavy winds. On side-span erection the workers rode the floor beam out from the deck.

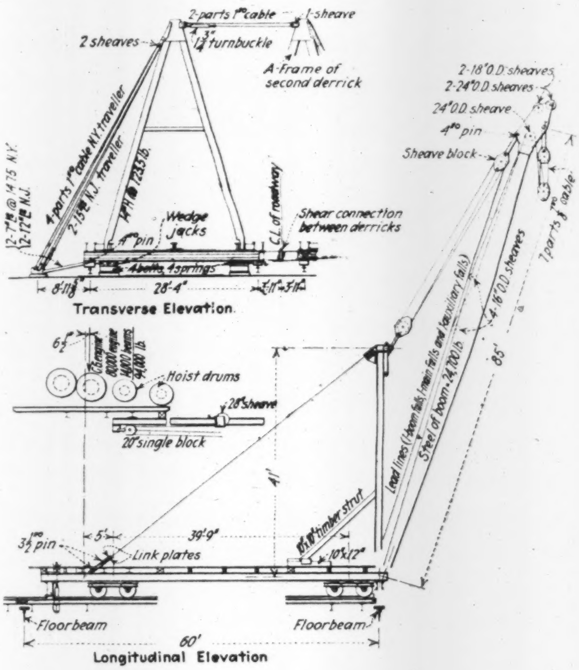

2-parts 1" cable
1-sheave
2 sheaves
1¾" 3" turnbuckle
A-frame of second derrick
2-18" O.D. sheaves
2-24" O.D. sheaves
24" O.D. sheave
4" pin
Sheave block
7 parts ⅞" cable
4-parts 1" cable N.Y. traveller
2-15" N.J. traveller
2-7" @ 14.75 N.Y.
2-12" N.J.
14" H @ 123.5 lb.
Wedge jacks
4" pin
C.L. of roadway
Shear connection between derricks
4 bolts, 4 springs
8'-11⅝"
28'-4"
3'-11" 3'-11"
Transverse Elevation
6½"
Engine 80,000 engine 14,000 beams 94,000 lb.
Hoist drums
28" sheave
20" single block
41'
Lead lines (1-boom falls, 1-main falls and 1-auxiliary falls)
Steel of boom - 24,700 lb.
4-16" O.D. sheaves
85'
10x10" timber strut
10"x12"
3½" pin
5'
39'-9"
Link plates
Floorbeam
Floorbeam
60'
Longitudinal Elevation

Fig. 13—General design of A-frame cable-backstay traveler used on main-span floor erection

Two of these travelers, used side by side as shown, speeded up erection and furnished the required capacity for picking the heavy floor beams.

No difficulty was encountered in closing the main span. In making this closure the New Jersey side was pulled toward the towers with turnbuckles, while jacks were used on the New York side. This was possible since the span at each tower was on a sliding surface, wind shear and half the vertical load of the adjacent panel being taken into the towers on sliding shoes. The closing chords were dropped in with ⅛-in. clearance, the connection made, and the jacks and turnbuckles removed at the towers.

During the early stages of erection, before the short suspenders near the center of the span had a restraining influence, the lateral motion at the end of this span due to wind was sufficient to cause the end of the windward stringers in the panel adjacent to the tower to run off their seat. To prevent this the wind chords were fixed to the columns, thus transferring not only the wind shear, but also wind moment, the span forming a lateral cantilever truss. After erection reached a point where the suspenders were short enough to restrain the end, this tie was removed.

A total of 312,500 field rivets was driven in erecting the floor steel. Air was furnished by compressors located on the ground near the towers. Wind chord splices were not riveted until the two adjacent chords were in a straight line, since this was the position in which they had been assembled in the shop for reaming. About ten panels of the main span were erected before the first splice was riveted. At a few splices at the middle of the river this condition (of three chord sections in a straight line) could not be obtained, and the chords were riveted with a slight curve in them.

Personnel—The Hudson River bridge is being built by the Port of New York Authority, O. H. Ammann, chief engineer, Allston Dana, engineer of design, and Montgomery B. Case, engineer of construction. All structural steel was furnished and erected by the McClintic-Marshall Co. For McClintic-Marshall, David S. Gendell, Jr., was manager of erection, W. B. Fortune, foreman on the New Jersey side, and H. G. Reynolds, foreman on the New York tower. Sterling Johnston designed the tower travelers. The writer was resident engineer on the work.

Wheel Tracks for Low-Cost Roads

Two types of wheel-track construction for pioneer roads are in experimental use abroad. Economy and rapidity of construction dictated the design of an experimental stretch of gravel roads with concrete wheel tracks, by Leslie Scott, of the public works department of Southern Rhodesia. This road, 16 ft. wide, has a 6-in. surface of compacted gravel in which are two 6-in. concrete tracks 2 ft. wide and 5 ft. 3 in. c. to c. As described in *The Surveyor* (London) by Mr. Scott, shallow trenches 6x24 in. were excavated and filled with concrete, the surface being screeded to the road camber or crown of 1 in 36. For curing and the prevention of too rapid drying by tropical heat, the trenches were well watered before the concrete was placed and the concrete was then kept covered with wet sacking and sand for fourteen days. After eight months' service the road was in good condition and the gravel had withstood torrential rains without excessive erosion. As built by native labor the cost was about $2,250 per mile. Advantages claimed include benefits for motor traffic, rapidity of construction, long life and low cost of both construction and maintenance.

In India an early type of railway track has been adapted to highway construction, with steel angles held at proper gage by transverse bars. The upstanding legs of the angles are inward, and the space between them is filled with earth or broken stone, while the road surface outside is level with the horizontal flange or track. The angles are laid upon beds of rolled or tamped gravel 12 in. wide and with a depth varying according to the soil, the minimum being about 18 in. in earth. It is claimed that this construction gives easy passage for vehicles of all kinds, the angles serving as tracks and guides, but it permits the vehicles to turn out easily for passing. It has been developed by H. W. Perry, and according to the *Railway Gazette* (London), experiments have led to its adoption by the Madras Provincial Railway for a 24-mile line.

Ingenious Form System Speeds Up Paving of Hudson River Bridge Floor

Easily stripped sheet-metal pans placed between bulb beams of floor system—Concrete handled by industrial railway using bulb beams for track—Pouring schedule of 240 ft. of 29-ft. roadway and 13-ft. sidewalk per day maintained

Wide World Photo

BY TAKING advantage of the special design of the floor system of the Hudson River bridge the contractor on the roadway and sidewalk paving developed an ingenious and novel form system and an unusual concrete-distribution layout to maintain a fast pouring schedule. In placing 9,540 lin.ft. of roadway 28 ft. 9 in. wide and a sidewalk 12 ft. $10\frac{1}{2}$ in. wide, a daily progress of 240 ft. was made. The form system for the roadway in which $5\frac{3}{4}$-in. longitudinal bulb beams, 15 in. c. to c., were incased consisted of sheet-metal pans, placed from the roadway deck and easily stripped from a traveler beneath the floor system. Wood-veneer panel forms were used for the sidewalk. Concrete materials were dry-batched at the base of the New York anchorage, hoisted to the deck level and then transported by railroad, using the bulb beams as tracks, to a paving mixer at the point of placement.

Several other finishing operations were included with the roadway contract. These were: placing of the roadway slab over the New York anchorage, 35,200 sq.ft., or 1,530 cu.yd.; filling the eyebar pits and keyways of in New York anchorage, 6,100 cu.yd.; placing 29,500 lin.ft. of railing and more than 50,000 lin.ft. of electrical conduits.

Design of Floor System

A typical cross-section of the floor system is shown in the plate on p. 643. For the present, traffic will be carried on two side roadways 28 ft. 9 in. wide, separated by steel curbs and railings from a future central lane $30\frac{1}{2}$ ft. wide, which will not be paved until traffic demands it. All of the structural steel of the central roadway is in place. Two sidewalks, 12 ft. $10\frac{1}{2}$ in. wide, are carried outside the roadway lanes directly under the cables, each protected by two substantial steel railings.

In the floor system the main cross-girders are suspended from the four 36-in. cables very 60 ft. Framing into these main cross-girders are ten longitudinal plate girders, eight under the roadway and two at the outside of the sidewalks. The roadway girders carry 16-in. transverse beams, 5 ft. 2 in. c. to c. Resting on top of the 16-in. beams are longitudinal bulb beams, $5\frac{3}{4}$ in. high and spaced 15 in. c. to c., which are incased in the roadway slab. These bulbs are continuous for the main 60-ft. panels. They are tied together with $\frac{3}{8}$-in. threaded bolts, 12 in. c. to c. A reinforcing mat of $\frac{1}{2}$-in. round bars was placed on top of the bulbs. The roadway slabs are nominally $5\frac{1}{2}$ in. thick, with haunches incasing the bulb beams, adding 3 in. to this thickness. The sidewalk slabs are 3 in. deep. Expansion in the roadway and sidewalk slabs is provided at the panel points (every 60 ft.).

Roadway Construction

Because of the unusual rigidity provided by the four suspension cables the usual balancing of floor loads during construction of suspension bridges was not required. Consequently, paving work started at one end, the New York anchorage, and was carried straight across the bridge without a break. The regular schedule was to pour on one side of the bridge for two days, then cross to the other roadway for two day's work.

Form System—For the roadways the bottom of the concrete slabs was designed to span between the longitudinal bulb beams with haunches to incase these beams, covering the top surfaces of the transverse beams. The contractor was faced with the problem of designing a simple, easily set and easily stripped form for approximately 46,000 individual openings. The placing of any

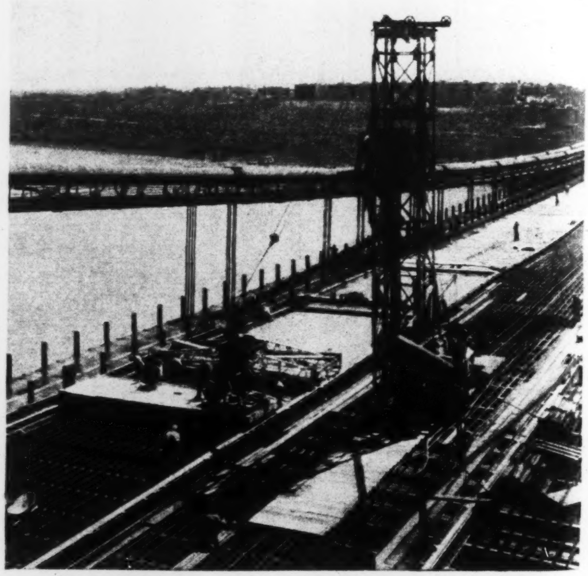


Fig. 1—A traveling concrete plant high above the Hudson

1-yd. paving mixer moved across bridge in unpaved central roadway lane, which was also used by railroad hauling batched aggregates, the longitudinal bulb beams of the floor system serving as tracks. Concrete was placed by buggies from traveling platform bridge, shown at extreme left. Mechanical screed can be seen beyond this platform.

type of form from the top of the deck would be complicated by the myriad of cross-ties connecting the bulb beams. A 14-gage sheet-metal inverted pan, built to the contour of the arched bottom to fit between the bottom flanges of the bulb beams, was the answer to the form problem. They were rigid and yet light enough to be easily handled and were set in place from on top and stripped from a traveling scaffold below.

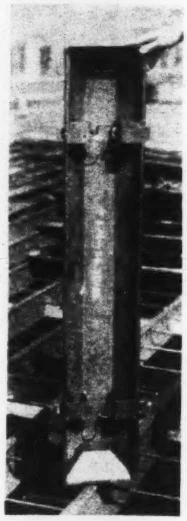


Fig. 2 — Bottom view of typical form pan

The pans, shown in Figs. 2 and 5, did not bear on the flanges of the bulb beams or cross-beams, but they were held in place by four sliding lugs which engaged the bottom flanges of the bulbs. The lugs worked through slots in the sides of the pan and in four welded straps, one for each lug. An arched wire spring held the lugs out into place when the forms were set. When stripping, releasing the springs permitted the lugs to be pulled back into the arch of the pan, then the form could be easily pulled from below.

In designing the pans it was contemplated that at least one of the cross-ties in each small panel would have to be removed to permit the forms to be set from above. But in actual practice it was discovered possible to slip the pans endwise into place without removing any of the rods. After each use the pans were thoroughly oiled. Most of the supplementary cross-beams of the floor system were regularly spaced 5 ft. 2 in. apart, and the majority of form pans were built in one piece to accommodate this length. But the distance between the main cross-girders and the adjacent cross-beams at each panel point varied somewhat. This condition required a form pan of adjustable length, made up of two parts, one sliding inside the other.

Plywood panel forms were used for the sidewalks. These panel forms were placed between sidewalk cross-beams 3 ft. 9 in. c. to c., two to the 12 ft. $10\frac{1}{2}$ in. of sidewalk width. These forms were carried on 2x4-in. stringers wedged up on the lower flanges of the sidewalk beams. All sidewalk forms were set from deck level without the use of scaffolds below. These were also stripped without the use of scaffolds, the men working from the windbracing of the floor system which extended the full length of the bridge.

Traveling Platforms—Stripping of the forms was done from two traveling platforms suspended below the structural steel of the deck, one under each roadway (Fig. 6). The roadway platforms were 40x66 ft. and rolled on three rows of hangers fastened to the main longitudinal bridge girders. At the bottom of each hanger were four rollers that engaged the upper flanges of longitudinal I-beams rigidly fastened to the top of the platform. The platform hung 2 ft. below the bottom of the main cross-girders. As the traveler moved past the rear hangers they were released and reset at the front

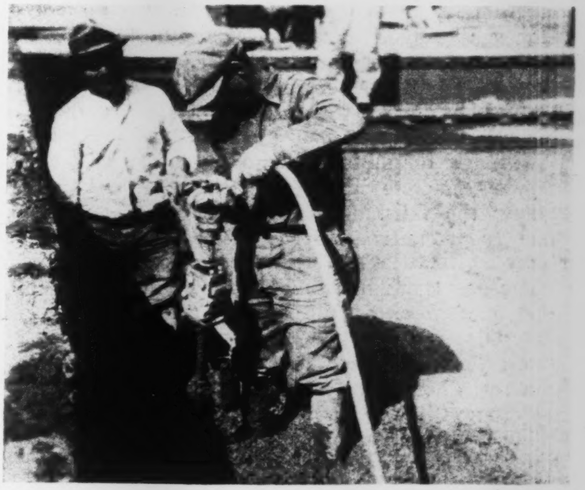


Fig. 4—A special pneumatic vibrator tamped the stiff concrete around bulbs and into corners

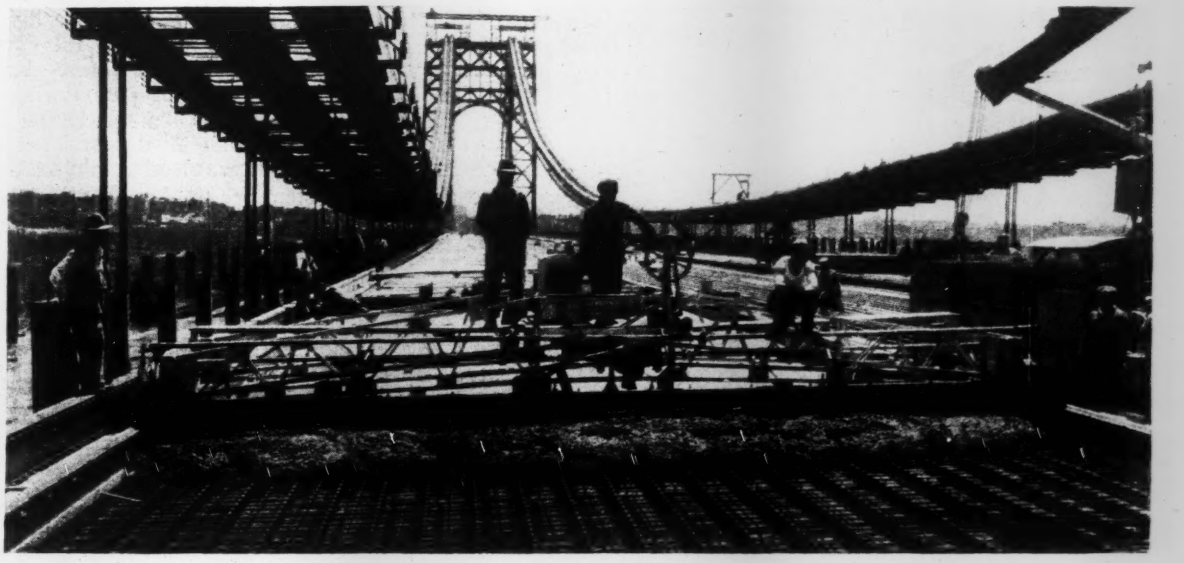


Fig. 3—This giant mechanical screed of 29-ft. span smoothed out the stiff concrete in the roadway slabs An aggregate train can be seen at extreme right, with mixer crane ready to pick up a batch box.

end to provide a continuous trackway. Propelling power was provided by a hand winch and cable.

Because of the depth of the main cross-girders (10 ft.) the men could not work directly from the platform but stood on planks placed between the bottom flanges of the longitudinal bridge beams, protected by the traveler platform below.

Roadway forms were left in place two full days before stripping; those for the sidewalk were not stripped until four days after pouring. The forms were dropped on to the platforms and then handed up through openings in the floor systems to deck level to be transported ahead.

Concrete Distribution System—Full advantage was taken of the open central roadway lane in the concreting operations. The long rows of bulb beams with their closely spaced tierods furnished a substantial and safe deck from which to work. Furthermore, by using equipment of 28¾-in. gage the regularly spaced longitudinal beams provided a dozen tracks for industrial railroad operation the full length of the bridge. Accordingly, the contractor bought two special gage, 5-ton gas locomotives and several sets of cars to handle dry-batched aggregates. A 1-yd. paver mounted on crawlers mixed the concrete at the point of deposit. The paver moved forward on planks on the central roadway. It was specially equipped with a small derrick at rear for dumping aggregate boxes, a hoist tower carrying concrete chutes and a large derrick for transferring the finishing machine and distribution equipment from one roadway to the other. A view of the mixer and distribution equipment is shown in Fig. 1.

The aggregate batching plant was located at ground level just west of the New York anchorage block. Materials were dry-batched and loaded into 1-yd. boxes. Two of these boxes were placed on a flat car, which was hoisted up a 164-ft. tower to deck level. The gas dinkeys handled two cars at a time from the tower to the mixer. Jump-over switches at the tower and the mixer permitted easy maneuvering of trains.

Concrete was mixed fairly dry and stiff. To insure proper placing of the concrete around the steel work, a special pneumatic vibrator, shown in Fig. 4, was used. The vibrator proved to be very effective in keeping the bottom corners filled and preventing honeycomb on the under side of the slab.

The roadway slab was finished with a mechanical screed and finishing machine spanning the whole width of the roadway (Fig. 3). Finishing of the sidewalk slab was done by hand. The surface of the roadway slab was checked to ⅛-in. variation in 10 ft. and then given a broom finish.

After finishing, the slabs were covered with four layers of burlap, which was kept wet for ten days. Water for mixing and curing operations was supplied through 2½-in. pipe line that had been used as an air line by the contractor on the floor erection.

Concrete Mix—The concrete mix of the slabs was approximately 1:1.8:2.4, with a 5.75 water ratio. A cubic yard of concrete consisted of .62 cu.yd. of sand, .71 cu.yd. of ¾-in. trap rock and 1.75 bbl. cement. Each of the roadway panels, 28 ft. 9 in. x 60 ft., contains 38.5 cu.yd. of concrete and 1.6 tons of reinforcing steel. The sidewalk panels, 12 ft. 10½ in. x 60 ft. contain 72 cu.yd. of concrete and 42 ton of steel.

Railings—Setting the railings was an interesting operation. It was desirable that all the railing posts be plumb after the bridge floor came to its final position after loading with the slabs. Inasmuch as the posts were incased in the concrete slabs they were necessarily set far in advance of the slab laying. Because the curvature of the floor system was much greater before placing of the slabs, each post was set out of plumb when being placed, the amount of tip being measured by special templet designed for each individual post. All of the railing and conduit material was hauled to place over the industrial railway system set up for handling the concreting of the floors. This material was hoisted to deck level by a stiff-leg derrick on the bridge floor.

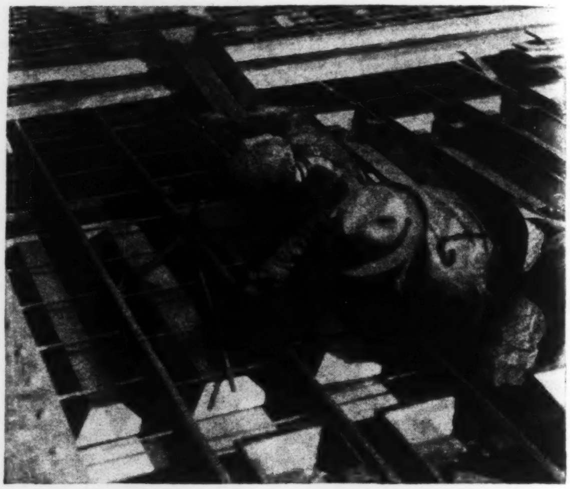


Fig. 5—The form pans were easily set from on top by two workmen

Pans are held by lugs resting on flanges of bulb beams. Illustration plainly shows tiebolts connecting bulb beams, which were a problem to any scheme of setting forms from on top. Reinforcing mat is yet to be placed on top of beams.

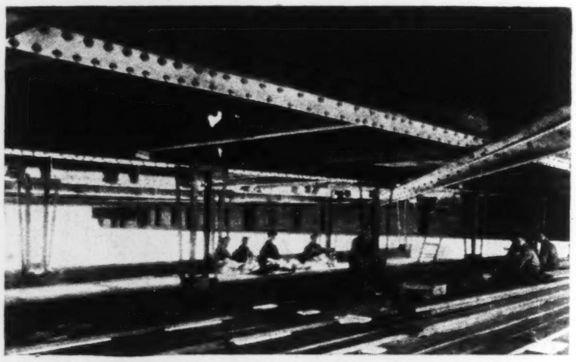


Fig. 6—Traveling platform from which roadway forms were stripped

Contractors and Personnel

The work was done under the direction of the Port of New York Authority, O. O. Ammann, chief engineer, Montgomery B. Case, construction engineer, and Homer R. Seely, resident engineer. Contract for the concrete work on the floor system was held by the Corbetta Concrete Corp., New York City. Roger H. Corbetta and Louis P. Corbetta were in personal charge, with Bruce Davis as superintendent and Joseph Lipset resident engineer for the contractor. The installing of the railings was sublet to the Globe Iron Works, New York, and the electrical conduits to the Wimpie Electrical Co., New York.

Complex Approaches Developed to Promote Efficient Use of Hudson River Bridge

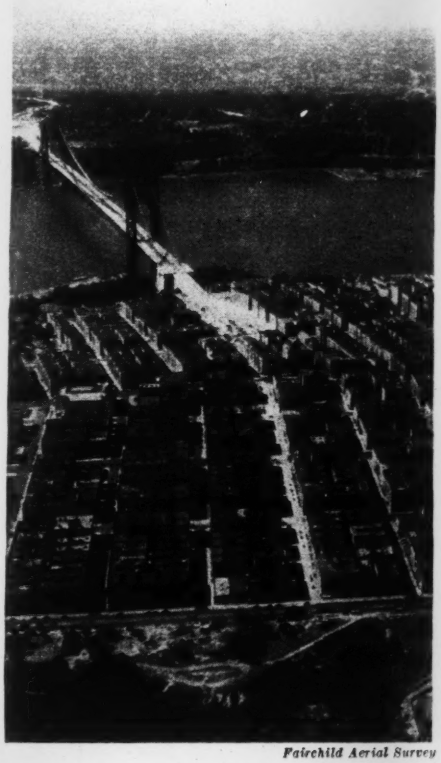
Elaborate layout in New York providing connections to main north and south traffic arteries with no grade crossings, and separated on-bound and off-bound traffic, includes two ventilated tunnels several blocks long—New Jersey highway department furnishes similar facilities for traffic distribution at west end of bridge

THE APPROACHES to the Hudson River bridge—the greatest of the world's suspension bridges—represent major engineering and construction projects in themselves. Fundamentally, the problems at the New York and New Jersey ends were the same, that is to facilitate the movement of bridge traffic by providing separate on-bound and off-bound roadways, by avoiding all intersections at grade and by limiting roadway gradients to 6 per cent. Varying local conditions at the two ends of the bridge, however, made the actual planning and construction of the two approaches quite different.

On the New York side, the existing streets are flanked by expensive structures, largely apartment houses. Traffic on these streets was comparatively dense and could not be interfered with unduly. Approach connections were required to four main north and south streets—Riverside Drive, Broadway, Amsterdam Ave. and the Harlem River Speedway—the latter over a mile distant from the bridge. The problem was further complicated by the fact that Riverside Drive, which is located just east of the New York anchorage, is about 100 ft. below the bridge roadway, making an extensive ramp connection necessary.

At the New Jersey end the bridge terminates about 50 ft. below the top of the rocky cliffs of the Palisades, requiring a deep cut of considerable length to reach the surface. A fairly steep grade also was a necessity in this cut to permit the approach to pass over a street that parallels the river.

Unlike Manhattan, most of the territory adjacent to the bridge in New Jersey is undeveloped, and the existing streets of the village of Fort Lee are not flanked by such expensive structures as found on Manhattan. The problem here was to distribute the traffic to state and county highways and to provide connections to village streets rather than to city thoroughfares The difference in the solution is made clear by the fact that about 18 acres of land are utilized in the Fort Lee approach, while only 8 acres were acquired for the facilities at the New York end.



Fairchild Aerial Survey

Fig. 1—Approaches to Hudson River bridge extend long distance from bridge to facilitate traffic collection and distribution

Amsterdam Ave., in the foreground of the view, on eastern edge of Manhattan Island, is reached by tunnels in 178th and 179th Sts., the first two cross-streets at right. New Jersey approach carries traffic nearly a mile west before making connections with state highways.

The New Jersey approach was worked out in collaboration with the New Jersey state highway department and local interests and is being built in large part by the state highway department. In New York the Port Authority collaborated with the city authorities but is doing all of the construction work itself.

New York Approach Plan

The plan of the New York approach embraces the following principal elements:

1. Ramps, plaza and street connections west of Pinehurst Ave. between 178th and 179th Sts. (Initially only a part of this complete layout is being constructed.)

2. Connections with Riverside Drive.

3. Ramps, plaza and street connections in the vicinity of Fort Washington Ave. from Pinehurst Ave. to Broadway, between 178th and 179th Sts. (A part of this development will be deferred until bridge traffic requires it.)

4. Tunnels under 178th and 179th Sts., between Fort Washington and Amsterdam Aves. (The 178th St. tunnel is practically completed, and work will start immediately on the one in 179th St. so that it can be put in operation two years after the bridge opens.)

The roadway of the Hudson River bridge is 90 ft. wide but the present development leaves a 30-ft. strip down the center unpaved. The initial capacity, therefore, will be only six lanes, and the first stage of the approach development is planned for this capacity.

Main Approach West of Pinehurst Avenue

In this section the entire block between 178th and 179th Sts. has been appropriated for approach purposes. In Fig. 2 is shown the layout of the approach in this area as it finally will be built. Fig. 4 shows the initial stage of construction, which forms in reality the

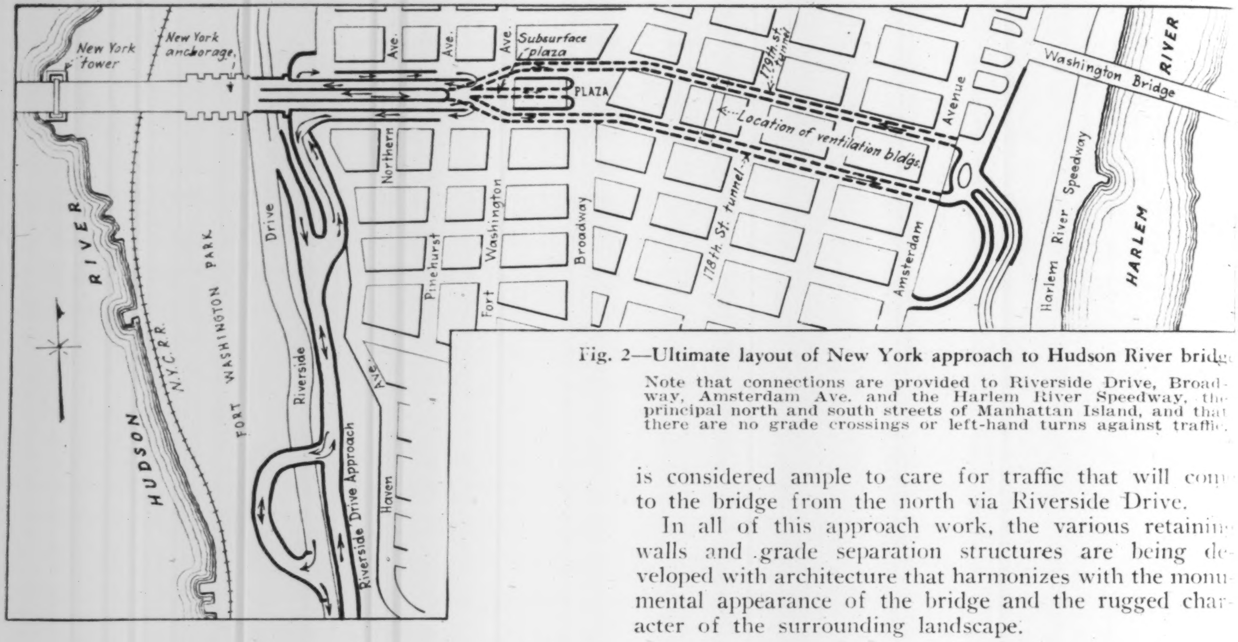


Fig. 2—Ultimate layout of New York approach to Hudson River bridg

Note that connections are provided to Riverside Drive, Broadway, Amsterdam Ave. and the Harlem River Speedway, the principal north and south streets of Manhattan Island, and that there are no grade crossings or left-hand turns against traffic.

core section of the finished approach. As finally built, the main ramp from the New York anchorage pier east to Pinehurst Ave., which also includes a concrete arch spanning 196 ft. over Riverside Drive and a parallel street, will be 145 ft. wide, made up of a central 60-ft. roadway and two 30-ft. side roadways, the rest of the width being occupied by sidewalks. The 60-ft. central roadway will drop away on a relatively steep gradient (— 4 per cent to Northern Ave. and — 1.82 per cent from Northern Ave. to Pinehurst Ave.) entering an underground plaza east of Pinehurst Ave. The side roads will slope downward more gradually to a surface plaza between Pinehurst and Fort Washington Aves. built over the underground plaza, and will afford connections with 30-ft. ramps to and from Riverside Drive. At present, only the central 60-ft. roadway is being built, the areas to be occupied by the ultimate side roadways being left vacant, as shown on Fig. 4, where they are marked "graded area." Widening of this main ramp to its ultimate width of 145 ft. is to be deferred until traffic volume on the bridge shall have reached 10,000,000 vehicles annually. At present, connection to the Riverside Drive ramps will be made at Northern Ave., where the grades of the central roadway and the ramps intersect, as shown in Fig. 3. The two side ramps, which connect with the Riverside Drive approach at Haven Ave., follow generally the existing grades of 178th and 179th Sts.

Riverside Drive Connections

Access to the bridge from Riverside Drive has been planned so as to provide complete separation of on-bound and off-bound traffic and to preclude any grade crossings at the intersections of the approach roadways with Riverside Drive.

Both the on-bound and off-bound roadways of this part of the approach are planned for a width of 30 ft., to accommodate three lanes of traffic, with the following exceptions: the on-bound roadway south of 172nd St. has a width of 35 ft. to provide for parking facilities, and the on-bound roadway west of Riverside Drive in Fort Washington Park has a width of 22 ft., which is considered ample to care for traffic that will com to the bridge from the north via Riverside Drive.

In all of this approach work, the various retainin walls and grade separation structures are being developed with architecture that harmonizes with the monumental appearance of the bridge and the rugged character of the surrounding landscape.

Layout Between Pinehurst Ave. and Broadway

The principal structure in this section is an underground plaza extending from a portal east of Pinehurst Ave. to the east side of Fort Washington Ave. and occupying the entire block between 178th and 179th Sts. Access to this plaza from the west is from the 60-ft. central roadway on the main approach ramp. At Fort Washington Ave. this underground plaza opens into tunnels under 178th and 179th Sts. that provide connections with Amsterdam Ave.

This underground plaza will be covered over with a steel superstructure, which in the final development of the plan will carry a surface plaza over which vehicles bound for Riverside Drive will pass, instead of turning off at Northern Ave., as in the present arrangement. Future development of the underground plaza also con-

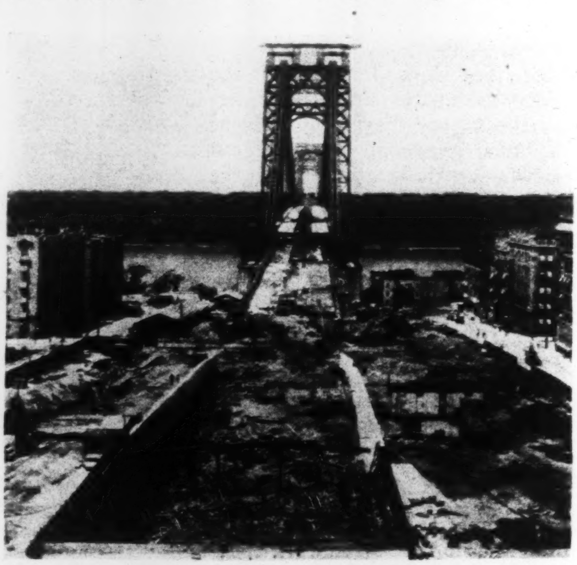


Fig. 3—Main ramp construction, New York

In foreground is portal to subsurface plaza. View shows how only center roadway of ramp is being built at present.

templates two 20-ft. ramps rising eastward to a surface plaza west of Broadway. Construction of these ramps is deferred until such time as traffic over the bridge reaches a volume of 10,000,000 vehicles annually. Under the present scheme, access to Broadway will be via the existing roadways in 178th and 179th Sts., which connect with the bridge roadway at Northern Ave.

Connections to Amsterdam Avenue

In order to provide access to the bridge from Amsterdam Ave., and incidentally from the Harlem River Speedway and Washington Bridge over the Harlem River, two-lane, mechanically ventilated tunnels (Fig. 10) about 2,500 ft. long are planned in 178th and 179th Sts., extending from the subsurface plaza west of Fort Washington Ave. to a surface plaza east of Amsterdam Ave. The tunnel in 178th St. is being built at the present time. Work on the 179th St. tunnel will be commenced six months after the bridge is opened, to be completed 1½ years later. Work at the present time also includes the widening of 178th and 179th Sts. from 36 ft. to 44 ft. by decreasing the sidewalk widths. Final widening of these streets to 80 ft. is planned for the future.

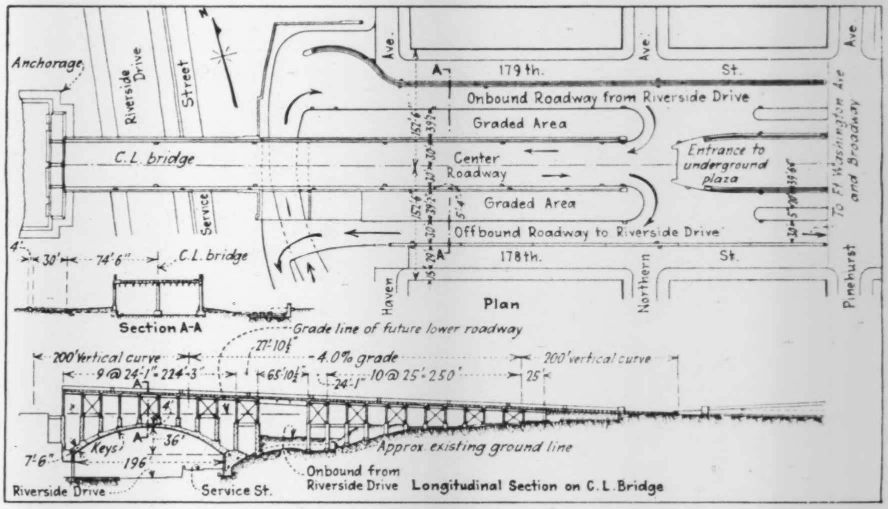

Anchorage
Riverside Drive
Street
Service
N
Ave.
Ave.
Ave.
A
179th. St.
Onbound Roadway from Riverside Drive
Graded Area
C.L. bridge
Center Roadway
Graded Area
Entrance to underground plaza
To Ft. Washington Ave and Broadway
Offbound Roadway to Riverside Drive
178th. St.
152'6"
39'2"
30'
20'
5'4"
15'
29'
39'6"
Haven
Northern
Pinehurst
Plan
4'
30'
74'6"
C.L. bridge
Section A-A
Grade line of future lower roadway
27'10½"
200' vertical curve
-4.0% grade
200' vertical curve
9 @ 24'-1" = 224'-3"
65'10½"
24'-1"
10 @ 25' = 250'
25'
A
4'
36'
Keys
7'6"
196'
Approx. existing ground line
Riverside Drive
Service St.
Onbound from Riverside Drive
Longitudinal Section on C.L. Bridge

Fig. 4—New York ramp layout as it is being built

Bridges and Ramps

Riverside Drive Arch—The arch bridge that carries the main approach ramp over Riverside Drive is designed for one of the heaviest unit loadings on record, 235,000 lb. per lineal foot. This compares with 47,000 lb. per lineal foot on the suspended span of the main bridge. Such a high loading results largely from the necessity for providing for a future lower deck capable of carrying four tracks of electric railway passenger lines.

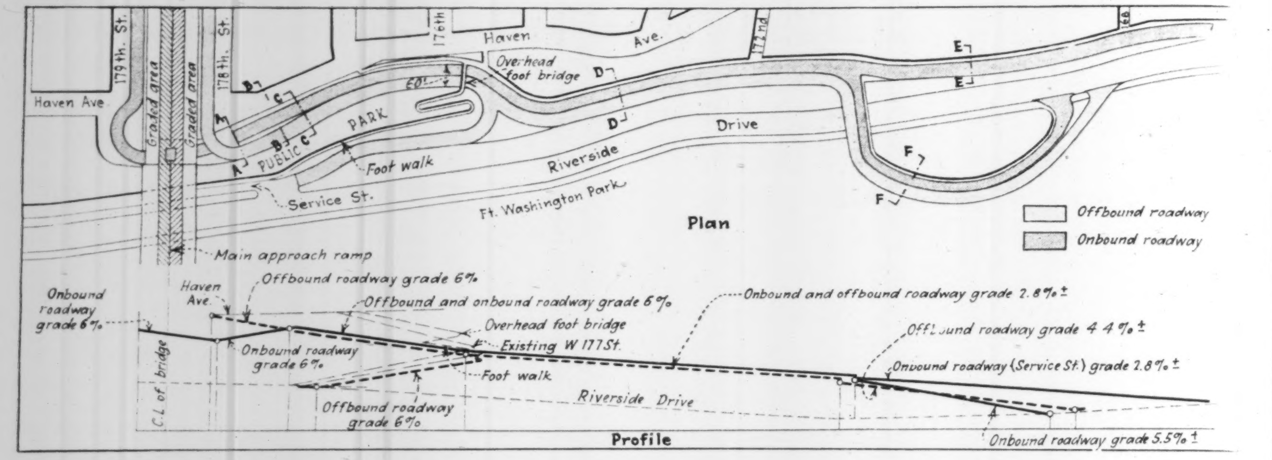
The bridge is of reinforced concrete, of barrel type, spanning 196 ft. across the Drive. The arch thrust at the west abutment is resisted by the main bridge anchorage, while at the east end it was possible to carry the thrust into the rocky hillside through a relatively small concrete block. The rise chosen—36 ft.—resulted from a balancing of practical and esthetic considerations, the practical factor being the elevation of the future lower bridge deck. A barrel design was deemed more efficient than one with ribs, in view of the flexibility it permitted in locating the railway tracks. Also the barrel design proved stronger.

As built, the barrel is 65 ft. wide and varies in thickness from 7½ ft. at the springing line to 4 ft. at the crown. This bridge is really the core of the final structure, which will be 145 ft. wide. Future widening will consist in adding two barrels 40 ft. wide to each side of the present structure. No provision is made for connecting these additions to the present bridge except through the roadway superstructure. This superstructure is somewhat unusual in that it is a combination of concrete and steel. As shown in Fig. 4, concrete cross-walls 25 ft. on centers and poured integral with the arch barrel terminate about 3 ft. below the grade of the future lower-level roadway, and on top of them the steel superstructure supporting the present 60-ft. roadway is placed. The concrete cross-walls are designed for unusually heavy concentrated loads requiring a large amount of reinforcing in the top of the walls and relatively thick concrete sections. The use of a steel superstructure to support the roadway will also be an advantage when the bridge structure is widened. The concrete portion of the arch was poured in sections following usual practice. The reinforcing steel was lapped in all keyways except those at the haunches, where the steep incline of the barrel made it advisable to carry the rods straight through into the abutment to insure against their sliding out of position.

The steel superstructure is three columns wide, the exterior columns being 14-in. 96-lb. sections, while the center column is a 24-in. 76-lb. section with 15-in. 33.9-lb. channels as covers. The roadway is carried on 60-in. plate-girder crossbeams and consists of a 9-in. concrete slab reinforced with bar trusses 6 in. deep spaced on 6-in. centers. An expansion joint is provided in the floor at every fourth panel point, designed with particular attention to its waterproof quality. The arch is equipped with a complete drainage system of wrought-iron piping through which all the rain water on the roadway surface is carried to a point of discharge near one of the abutments.

The initial construction provides spandrel walls of gunite placed on wire mesh, masking the structural superstructure. When the bridge is widened to 145 ft. it will be faced with granite to match the abutments and the rest of the approach work.

Main Ramp—The main ramp structure east of the arch is of conventional braced steel-tower construction resting on a concrete column substructure, the top of the latter being about 3 ft. below the future lower-level roadway. Immediately east of the Riverside Drive arch this ramp is pierced by the on-bound roadway of the Riverside Drive connection, and here the ramp roadway is carried by 92-in. plate girders on a 66-ft. span. In the rest of the ramp structure the longitudinal floor members are 24-in. I-beams. Cross-girders throughout the ramp are built-up plate girders 60 in.


179th. St.
Graded area
Graded area
178th. St.
176th
Haven
Ave.
Haven Ave
172nd
168
Overhead foot bridge
60'
A
B
C
D
E
F
PUBLIC
PARK
Foot walk
Riverside
Drive
Service St.
Ft. Washington Park
Main approach ramp
Plan
Offbound roadway
Onbound roadway
Onbound roadway grade 6%
Haven Ave.
Offbound roadway grade 6%
Offbound and onbound roadway grade 6%
Overhead foot bridge
Existing W 177 St.
Onbound roadway grade 6%
Foot walk
Offbound roadway grade 6%
C.L of bridge
Riverside Drive
Onbound and offbound roadway grade 2.8% ±
Offbound roadway grade 4 4% ±
Onbound roadway (Service St.) grade 2.8% ±
Onbound roadway grade 5.5% ±
Profile

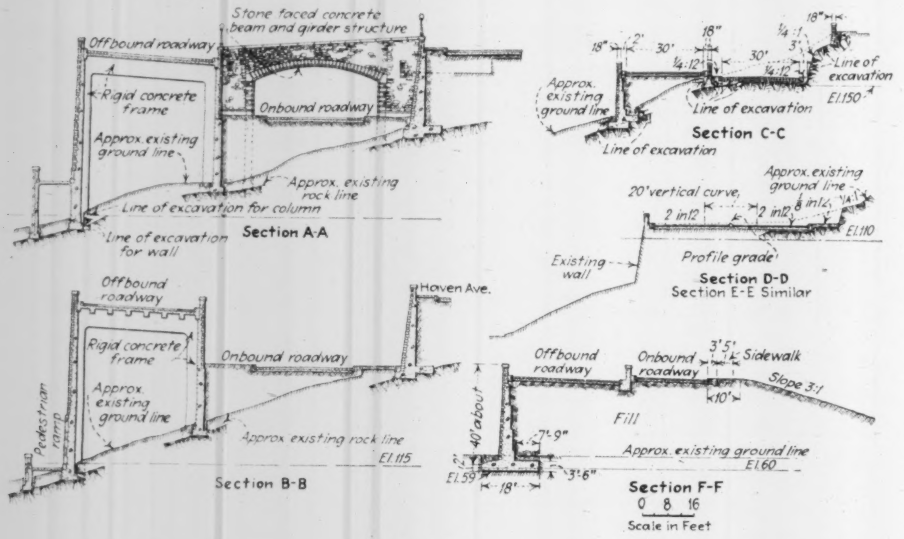

Stone faced concrete beam and girder structure
Offbound roadway
Rigid concrete frame
Onbound roadway
Approx. existing ground line
Approx. existing rock line
Line of excavation for column
Line of excavation for wall
Section A-A
18"
2'
30'
18"
¼:12
30'
¼:12
¼:1
3'
18"
Line of excavation
El. 150
Approx. existing ground line
Line of excavation
Line of excavation
Section C-C
Offbound roadway
Rigid concrete frame
Onbound roadway
Haven Ave.
Pedestrian ramp
Approx. existing ground line
Approx existing rock line
El. 115
Section B-B
20' vertical curve,
2 in 12
2 in 12
⅛ in 12
¼:1
Approx. existing ground line
El. 110
Existing wall
Profile grade
Section D-D
Section E-E Similar
Offbound roadway
Onbound roadway
3'
5'
Sidewalk
Slope 3:1
10'
Fill
40' about
7'-9"
Approx. existing ground line
El. 60
El. 59
2'
18'
3'-6"
Section F-F
0 8 16
Scale in Feet

Fig. 5—Complete separation of on-and-off-bound traffic with no grade crossings and 6 per cent maximum grades are characteristic of Riverside Drive connections

deep. The east 100-ft. of the ramp is a retaining wall structure.

In the roadway design for this ramp an interesting detail was worked out to insure bond between the stringers and the concrete slab. On each 25 ft. length of stringer, four 5x3-in. bulb angle clips are fastened to the top flange and concreted into the slab. The bond thus secured makes the stiffness of the combined I-beam and slab about three times the stiffness of the I-beam stringer alone.

Near the point where the on-bound roadway from Riverside Drive pierces the main ramp, it also passes beneath the off-bound roadway leading to Riverside Drive. The grade separation at this latter point is made by means of a heavy concrete beam structure of about 40 ft. span. Because of the sharp curve in the off-bound roadway, this concrete beam framing is extensive and somewhat complex. The portal opening is faced with stone to simulate a rigid frame or a flat arch.

Riverside Drive Approach—The major portion of the structure in the Riverside Drive connection layout is of retaining-wall type, built into the hillside. This is true of all of the approach on the east side of Riverside Drive. An exception exist near the north end where a section of the off-bound roadway is designed as a rigi frame structure, to resist th earth pressure existing on th uphill side. A gravity retaining wall while satisfactory would have projected into th roadway area. The rigid frame by utilizing the resistance of both legs retained th earth equally well and provided a maximum roadway width.

The approach structure on the west side of Riverside Drive is interesting in that it consists of a tall retaining wall placed on a fill. Comparative estimates showed that this type of structure was cheaper than a viaduct. Also, there was considerable excess excavation from other parts of the work which could be economically utilized in filling between the retaining walls. The base of the wall was poured continuous since uniform settle-

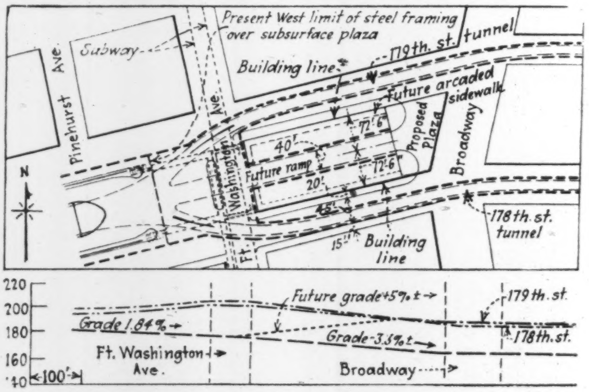

Present West limit of steel framing over subsurface plaza
Subway
Pinehurst Ave.
Building line
179th. st. tunnel
Future arcaded sidewalk
72'6"
40'
Future ramp
72'6"
20'
45'
Proposed Plaza
Broadway
Washington Ave.
Ft.
N
178th. st. tunnel
15'
Building line
220
200
180
160
140
100'
Future grade+5%±
179th. st.
Grade 1.84%
Grade-3.5%±
178th. st.
Ft. Washington Ave.
Broadway

Fig. 6—Subsurface plaza between Pinehurst and Fort Washington Aves. affords access to tunnels and future Broadway ramp

Plaza on top of subsurface layout in final plan will furnish turning point for Riverside Drive traffic and provide connection with Fort Washington Ave.

ment was to be expected. The walls, however, are broken every 50 ft. by an expansion joint.

The portions of the approach on the east and west sides of Riverside Drive are connected by means of a reinforced concrete arch spanning 120 ft. over the Drive. It is irregular in cross-section, because the two roadways that it carries are at different elevations. The arch is comparatively flat and for this reason a broken joint is utilized at the center of the span cutting through the parapet walls, thus relieving the arch from any floor or wall action. As on the main arch, a complete drainage system of wrought iron piping is installed to carry away rain water.

The arch barrel is 75 ft. wide, the roadway being carried on concrete cross-walls placed on 11-ft. centers. The arch barrel is reinforced with ¾-in. rods on 18-in. centers transversely, 1-in. rods on 6-in. centers longitudinally and ⅝-in.-diameter stirrups. An interesting feature of this structure is the relative size of the two abutments. Rock at the east end outcrops at the ground surface, requiring only a small abutment. At the west end however, it was necessary to excavate a hole 26 ft. wide, 44 ft. deep and 80 ft. long, in order to uncover sufficient rock of a satisfactory character for foundation requirements. The concrete required in this west abutment exceeds the total volume of concrete required in the arch superstructure and the east abutment combined. The arch is faced with stone.

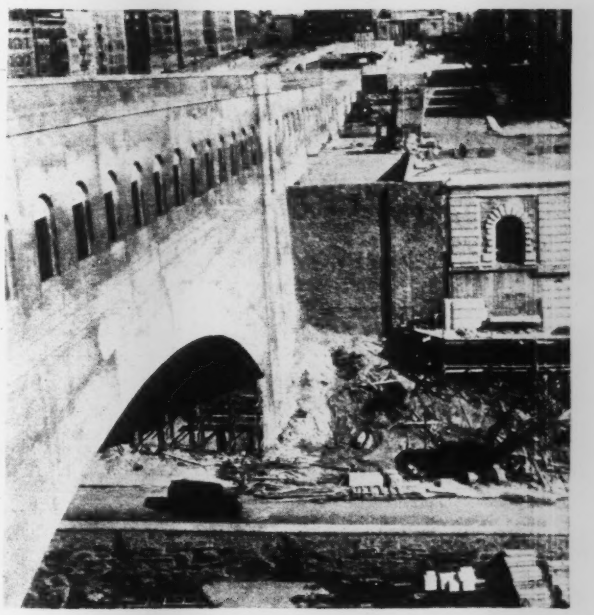


Fig. 9—Riverside Drive arch in present stage of development is masked by gunite curtain walls

View looking east from bridge anchorage, with off-bound roadway of Riverside Drive connection straight ahead.

Approach Pavements—Several different types of pavements are utilized to meet the varying conditions in the different parts of the approach. The roadway paralleling and east of Riverside Drive is paved with sheet asphalt. Traffic here will not be heavy, and the grade is relatively light. On the curved portion of the approach west of Riverside Drive, asphalt block pavement is specified because of its non-skid properties. For the north half of the Riverside Drive connection near the main bridge, where grades are steep and several short and sharp curves occur, granite block is being laid. On the main approach ramp, the concrete slab will be utilized as the wearing surface. The tunnels are also to be provided with concrete roadways.

Tunnels—The tunnels under 178th and 179th Streets, from Fort Washington Avenue to Amsterdam Avenue, are of identical section and plan. In general, their design follows usual subway practice with the exception that ventilation ducts are provided. Each tunnel is a concrete box about 40 ft. wide and 20 ft. high in outside dimensions, made up of steel bents on 5-ft. centers

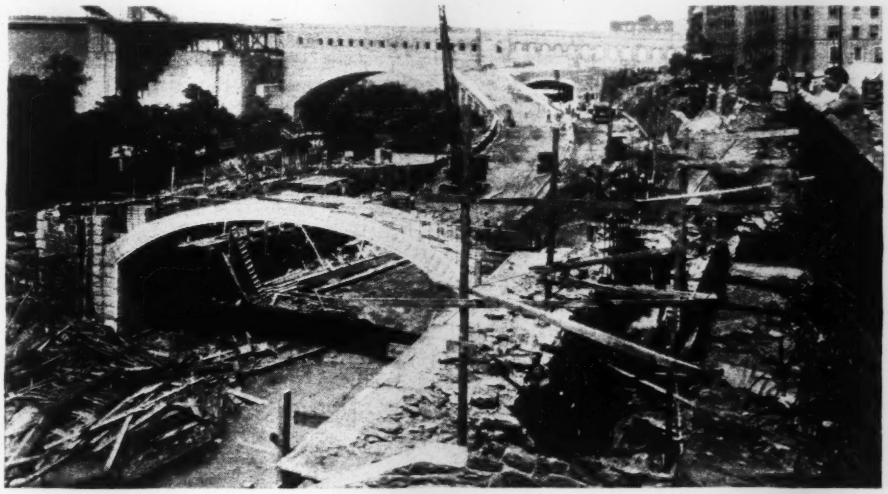


Fig. 7—Riverside Drive connection roadways were largely cut out of a rocky hillside

The bridge in the foreground connects pedestrian ramps on either side of the approach roadway.

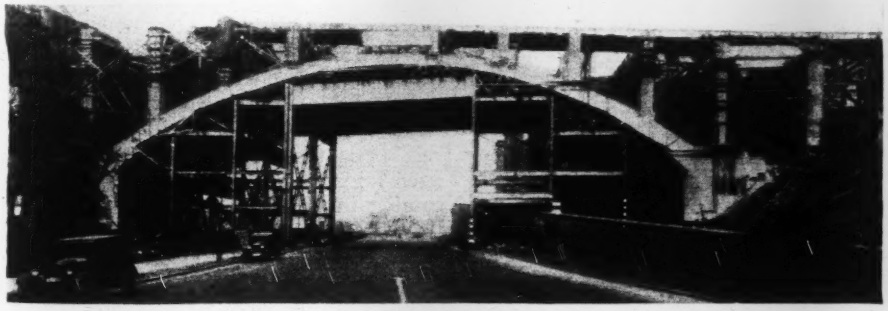
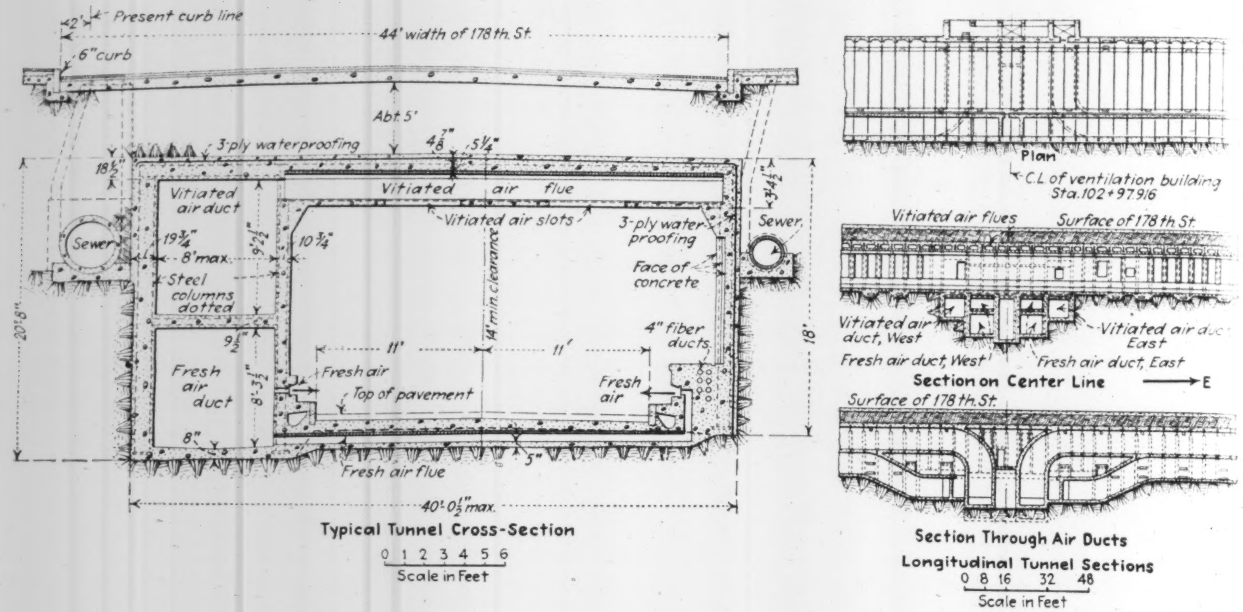


Fig. 8—Concrete arch carrying main ramp over Riverside Drive is designed to carry unusual load of 235,000 lb. per ft.

The future railway deck will rest on top of construction shown in view. Present highway deck is carried overhead on a steel superstructure, as shown in Fig. 4.


2'
Present curb line
6" curb
44' width of 178 th. St.
Abt. 5'
3-ply waterproofing
4 7/8"
5 1/4"
18 1/2"
Vitiated air duct
Vitiated air flue
Vitiated air slots
3-ply waterproofing
3 1/2"
Sewer
Sewer
19 3/4"
8' max.
9 1/2"
10 3/4"
Steel columns dotted
14' min. clearance
Face of concrete
20'-8"
18'
9 1/2"
11'
11'
4" fiber ducts
Fresh air duct
8'-3 1/2"
Fresh air
Top of pavement
Fresh air
8"
5"
Fresh air flue
40'-0 1/2" max.
Plan
C.L. of ventilation building Sta. 102+97.916
Vitiated air flues
Surface of 178 th. St.
Vitiated air duct, West
Vitiated air duct, East
Fresh air duct, West
Fresh air duct, East
Section on Center Line
E
Surface of 178 th. St.
0 1 2 3 4 5 6
Scale in Feet
0 8 16 32 48
Scale in Feet

Typical Tunnel Cross-Section

Section Through Air Ducts

Longitudinal Tunnel Sections

Fig. 10—Typical sections of ventilated tunnels in 178th and 179th Sts. that will carry traffic to and from the east side of Manhattan Island

incased in plain concrete at the air ducts and connected by concrete jack arches on the side opposite the ducts. Inside of this box the roadway occupies an opening 22x14 ft., providing for two lanes of traffic between curbs 22 ft. apart. The fresh and vitiated air ducts are located at one side of the box, separated from the roadway and from one another by concrete walls. The vitiated air duct is over the fresh air duct. Fresh air is admitted to the tunnel immediately above the curb on both sides of the roadway, fresh air flues on 15-ft. centers beneath the roadway providing connection with the discharge opening at the far curb. Vitiated air flues on 15-ft. centers occupy the spaces between transverse roof beams; air exhausted into these flues through slots in the ceiling above the roadway is drawn into the vitiated air duct beside the roadway, through which it finds its way to the ventilation building.

This ventilation building is placed about midway of the tunnel length in the block between 178th and 179th Sts. It serves four separate and distinct ventilatin systems—that is, each tunnel is divided into two system running from the ventilation building either way to th portals. Inasmuch as the ventilation building is on th opposite side of the tunnel from the air ducts, connection with them is through a transverse tunnel excavate in rock beneath the main tunnel roadway (Fig. 10).

The 178th St. tunnel, the first to be constructed, ha been built by the usual cut-and-cover method. Its roo is only about 5 ft. below the street level, so that worl was not difficult. At Fort Washington Ave. the tunne passes over the line of the new Eighth Ave. subway, requiring careful but not otherwise difficult construction. A large-scale rock excavation job was also required in building the subsurface plaza west of For Washington Ave. A plan of this plaza as well as th overhead plaza, which, in the final plan, will serve a a turning area for Riverside Drive-bound vehicles, i shown in Fig. 6.

Plan of New Jersey Approach

The New Jersey approach to the Hudson River bridge is primarily a collecting and distributing agency for traffic, in contrast to the layout at the New York end, which is made up essentially of connections to streets that intersect the center line of the bridge. It was deemed desirable in planning the New Jersey approach to accomplish the actual traffic distribution at as great a distance from the bridge as economical and physical considerations would permit, and at the same time to avoid all semblance of a plaza where undue concentration of traffic could occur. Accordingly distribution facilities are spread over about a mile of the approach that terminates on the edge of a plateau overlooking the Hackensack River valley. Three state highways from the north, northeast and south, respectively, are made to converge near the western limit of this plateau, and a network of highways and grade-separation structures results that gives the appearance of complication but is designed to eliminat all grade crossings and safely speed up traffic. Th remainder of the approach between this point and th bridge contains numerous simple under- and over-crossings and ramp connections to existing streets in th village of Fort Lee.

Extending west from the bridge the main approac road is a depressed highway varying from 60 to 100 ft in width and passing in order under Lemoine, Center, Linwood and Fletcher Aves. The first street west fron the bridge, Hudson Terrace, is crossed on a viaduct.

In describing the approach layout it may be considered as being made up of three principal parts: (1) the toll plaza between Hudson Terrace and Hoyt St.; (2) the connections to the several streets listed above; and (3) the distributing branches leading to the thre

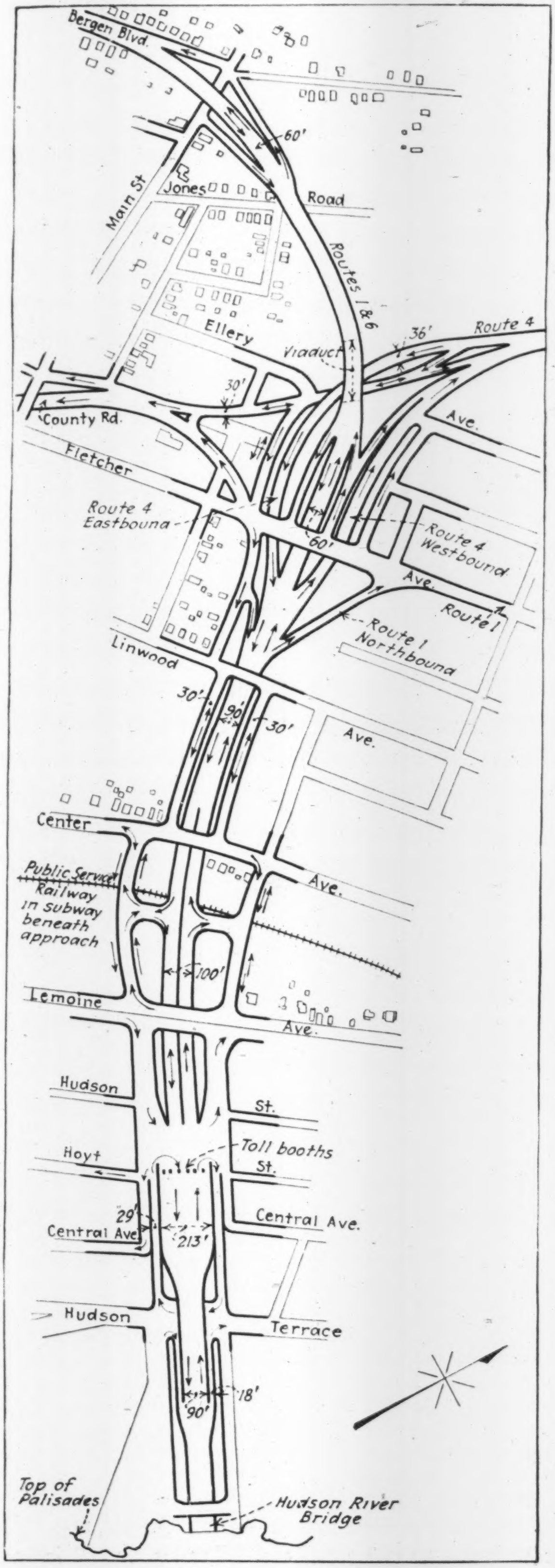


Fig. 11—New Jersey approach to Hudson River bridge is a vast collecting and distributing agency for traffic, in which all grade crossings have been eliminated

state highways. The Port of New York Authority designed the approach as far west as Lemoine Ave. but is only building the section from the end of the bridge to Hoyt St. The Port Authority is paying the New Jersey highway commission $500,000 for building the portion between Hoyt St. and Lemoine Ave., and has contributed $2,500,000 to the cost of the approach work beyond that point, which has been designed and is being built under state highway contracts.

New Jersey Toll Plaza—All tolls will be collected at the New Jersey end of the bridge. To facilitate this operation the 100-ft. roadway at the beginning of the approach, which corresponds to the total roadway width on the bridge, is flared out to nearly 200 ft. after it crosses over Hudson Terrace. This 200-ft. width provides space for eight toll-collection booths and side ramps, as shown in Fig. 11.

Hudson Terrace is the only cross-street that passes under the approach, the other intersections being overcrossings. Traffic to and from Hudson Terrace utilizes ramps at either side of the main approach roadway. The three streets paralleling Hudson Terrace to the west do not cross the approach but are dead-ended into so-called marginal roadways outside the ramps. These marginal streets are readily accessible from the main approach roadway immediately west of the toll booths.

Cross-Street Connections—From the toll booths west to the state highway distributing points (Fig. 11) the approach is a depressed roadway 100 ft. wide. All cross-streets are carried over on concrete-incased steel-girder bridges of one or two spans. In the case of two-span structures the center pier with islands divides the east and westbound traffic. There are three of these cross-streets—Lemoine, Center and Linwood Aves. Local traffic facilities are provided between Lemoine and Center Aves. by means of a cloverleaf layout of ramps, and between Center and Linwood Aves. by means of marginal streets connecting with Center Ave. and the cloverleaf system. The layout and construction of the cloverleaf were somewhat complicated by the presence of a trolley line just east of Center Ave. that crosses the approach in a subway below.

Distributing Roads—West of Linwood Ave. begin the facilities for distributing the traffic to the various state highways, all of which are entirely new routes being built in large measure as an integral part of the approach project. Reference to Fig. 11 with careful attention to the arrows denoting direction of traffic flow will be necessary to understand this distribution layout, which is probably as complicated a bit of grade-separation work as has ever been undertaken.

Routes 4 (from the north) and 6 (from the south) have the bridge as their terminus. Route 1 bypasses the bridge, coming in from the south over route 6 and continuing in a northeast direction from the distribution layout.

Bridge traffic moving west under Linwood Ave. and entering the distribution road layout first encounters a branch to the right, which leads to route 1 northbound. The next branch to the right leads under Fletcher Ave. to route 4 northbound. Traffic keeping straight ahead on the main approach roadway runs into routes 1 and 6 southbound. These are the three principal alternatives for bridge traffic bound west.

Similar facilities, with no intersections at grade, are provided for traffic originating on any of the three main highways and bound for the bridge. Thus traffic from the north on route 1 crosses over all of the approach roadways on the Fletcher Ave. viaduct and makes a left turn onto a ramp that leads eastbound down to the main approach. (If this traffic wishes to continue south on route 1, it turns right on a westbound ramp from Fletcher Ave. that leads down to the main approach roadway.) Traffic from the north on route 4 passes under the main approach (and incidentally over a county road, making a three-level grade separation at this point), thence under Fletcher Ave. and into the main approach. Traffic from the south on routes 1 and 6 enters directly onto the main approach west of Fletcher Ave. if it is bound for the bridge. If it is bound north on route 1, it leaves the main approach on an eastbound ramp leading up to Fletcher Ave., where it makes a left turn onto route 1.

Structures in the New Jersey Approach

For the most part the grade-separation structures in the New Jersey approach are of simple design and construction. Standard express highway design was utilized for the slab of the main approach road, which is built in a cut whose rock sides are self-supporting. The viaducts that carry Lemoine, Central, Linwood and Fletcher Aves. over the main approach cut are all of similar design—concrete-incased rolled girder beams on concrete abutments with wide wing walls. The steel girder beams are equipped with a fixed shoe at one end, while the opposite shoe is fitted with slotted anchor-bolt holes that permit expansion. The 8-in. concrete roadway slabs are poured integral with the beam incasement. Parapet walls, abutment faces and pier faces (where used) are bush-hammered for architectural effect. Ornamental concrete railings complete the structures.

At Hudson Terrace, where the approach roadway is carried overhead, the viaduct structure, 135 ft. long, consists of three transverse steel bents, each six columns wide, that carry the 90-ft. approach roadway. East of Center Ave. the main approach is carried over a street railway in a concrete box subway.

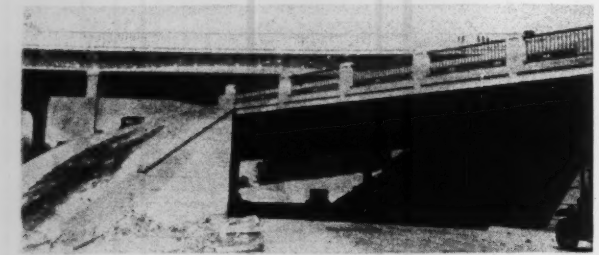


Fig. 12—Three-level grade separation in which route 4 eastbound passes beneath main approach viaduct and over county road

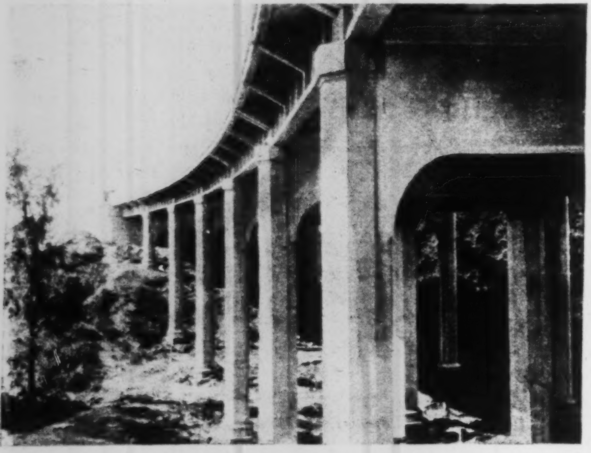


Fig. 13—Main approach viaduct consists of concrete-incased steel girders on three-column reinforced-concrete bents

The three-level grade-separation point near the western limits of the approach presents the most interesting structural layout of the project. The main approach roadway is carried overhead on a high-level viaduct that crosses a deep wide valley. At its eastern end this viaduct crosses over route 4 eastbound, which in turn spans a county road running north and south.

In general, all structures are of steel girder design incased in concrete. The three-column bents that support the high-level viaduct are of reinforced concrete except for two skew bents in the vicinity of the grade separation, which utilize rolled steel columns. Steel is used for these columns to facilitate the viaduct floor framing connections, which are complicated because of the skew layout.

The structure that carries route 4 eastbound over the county road is on a 33 deg. skew and consists of two long plate girders 8 ft. deep, spaced 42 ft. apart by 36-in. plate-girder floor beams on about 7-ft. centers. The bottom flanges of the floor beams frame into the bottom flanges of the longitudinal girders, so that the upper parts of these girders serve as railings for the bridge. The roadway is 36 ft. wide between curbs and consists of a $9\frac{1}{2}$-in. concrete slab.

The main viaduct structure is 62 ft. 4 in. wide between outside columns, the main framing of the roadway structure on top of the three-column bents consisting of longitudinal lines of girders. The two plate girders over the outside columns are 66 in. deep, while 36-in. rolled girder beams on 6 ft. 9 in.-centers constitute the interior floor framing. These beams are fitted with $\frac{3}{4}$-in. bearing plates at either end. Slotted holes in the bearing plates at one end permit expansion. The beams are braced transversely by the $10\frac{1}{2}$-in. concrete roadway slab. Sidewalks 5 ft. wide are cantilevered on brackets on either side of the structure.

The tallest concrete bent in this main viaduct is about 45 ft. from base of column to bridge seat. Columns are octagonal in plan, from 3 ft. 9 in. to 4 ft. 3 in. across, and are reinforced by $1\frac{1}{4}$-in. vertical square bars and $\frac{1}{2}$-in. square hooping. The cross-girders of the bents are 8 ft. deep and 3 ft. 4 in. wide, reinforced top and bottom by $1\frac{1}{4}$-in. square rods and with $1\frac{1}{4}$-in. square stirrups. No transverse bracing is used between the columns of a bent, and there is no longitudinal bracing between the bents.

Personnel—The development of the approaches for the Hudson River bridge was under the direction of J. C. Evans, terminal engineer, Port of New York Authority. Montgomery B. Case is engineer of construction and had as resident engineers Homer R. Seely and R. F. Wheadon at the New Jersey and New York ends, respectively. For the New Jersey highway commission, J. L. Bauer is chief engineer; Morris Goodkind, bridge engineer; and R. M. Beck, engineer of the metropolitan division, is in direct charge of the New Jersey approach work.

The New Jersey approach is being built by George M. Brewster & Son, Bogota, N. J. On the New York approach the main ramp and 178th St. tunnel is being constructed by the Cornell Contracting Corp., New York. The Riverside Drive connections have been built by Wm. P. McGarry Co., New York.

Well Points Drain Swamp Under Bridge Approach Structure

Peat bog dried up and removed to provide foundations for street-car subway crossing New Jersey approach to Hudson River bridge after the piling proves unstable

A DIFFICULT foundation problem in building a concrete box subway to carry the Public Service electric railway line through a peat bog across the New Jersey approach to the Hudson River bridge was solved by the effective use of well points. Original designs for the subway foundations called for creosoted piling driven through 25 ft. of swamp to rock. After driving the first few piles it was found that the muck offered little lateral stability to the piles, and therefore their use was impossible. Many schemes were then proposed to provide suitable foundations. It was finally decided to install a well-point system to dry up that part of the bog underlying the proposed subway, then to remove the swampy material to rock, backfill with good material and place the subway structure directly on the new fill. This scheme was entirely successful.

The Public Service street-car line runs parallel to and about one half mile west of the Hudson River, across the west end of an extensive swamp. For years a single track has been carried across this swamp on a stable fill. Three main roadway approaches to the Hudson River bridge cross the street-car line at almost right angles (Fig. 12, p. 664). As the new roadways are carried across the swamp on fills at a considerably higher level than the street-car grade, a series of four-track concrete subway boxes, totaling 660 ft. in length, with connecting retaining walls and wings, were designed to separate the highways and railway. All of the structures were designed to be carried on wood piling.

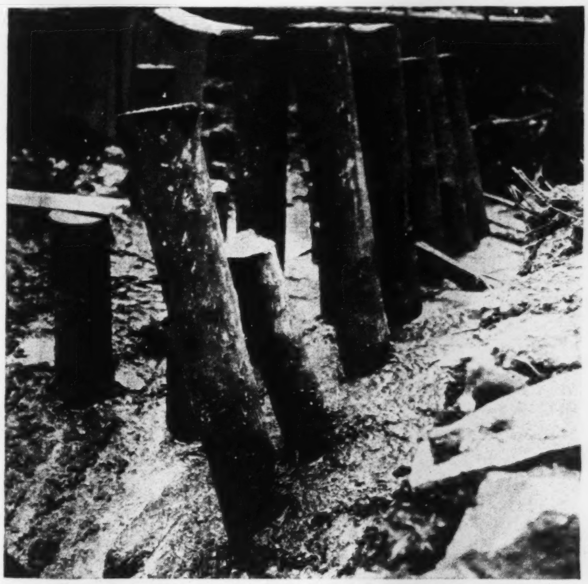


Fig. 1—Why pile foundations were not suitable for subway foundations in New Jersey swamp

Street-car service was diverted during construction operations. Piledriving was started at the south end of the job by a gas crane working from the old railroad grade. It was soon apparent that pile foundations would be unsuitable. The piles would not stay down, and after driving several the surrounding ground became a soupy muck that gave the piles no lateral support. Some other type of foundation was necessary.

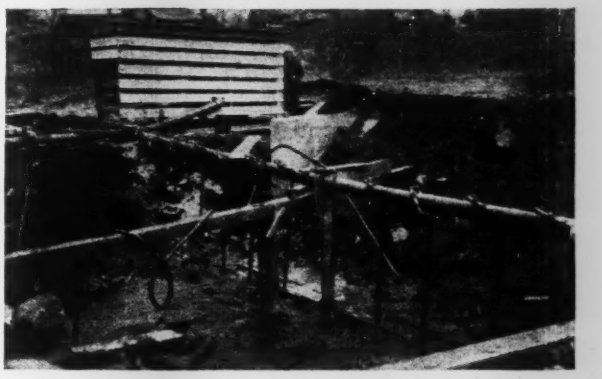


Fig. 2—End of one of two headers of the well-point system that drained an area 65x600 ft.

One of the five centrifugal pumps is within shanty.

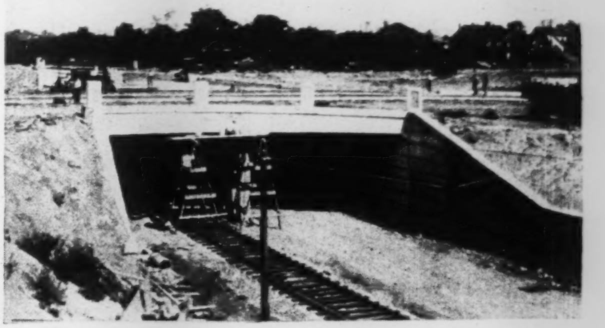


Fig. 3—One of the new subway sections about completed

The main center approach road will cross this structure.

In as much as ledge rock was about 25 ft. below grade, a proposed scheme to dry up the muck, dig it out and replace it with good material seemed feasible. A well-point system was installed for the purpose of drying out that part of the bog. Two header pipes were placed 65 ft. apart, extending for 600 ft. along the outside lines of excavation. Well points were driven to rock every 3 ft. along these header lines, each point being connected directly to the header. The whole assembly was hooked up to five centrifugal pumping units.

Pumping was started at the south end of the job. The ground was soon dry enough to permit excavating. Digging was done with a clamshell bucket handled by a gas crane, the crane at first operating on the old railroad grade, backing away from the hole as excavation progressed. Excavated material was loaded into trucks backed down the railroad grade from a ramp at the center of the job.

The well points proved very effective in drying up the material, not only between header lines but far enough outside to permit the excavated banks to stand on a reasonable angle of slope. As the excavating progressed northward, filling-in followed from the south end, leaving but a comparatively small area open at any one time.

After the new fill was started, the crane was transferred from the old railroad grade to the new fill. Another crane was then brought into use, the machines working side by side but swinging in opposite directions. Well points were removed with the excavation. A total of 58,000 cu.yd. of muck was removed. Backfilling required 40,000 cu.yd. of material, the backfilled grade being below original ground level. The new fill was thoroughly rolled before the invert slabs of the subway structures were poured.

The subway was built by the bridge department of the New Jersey state highway commission, under the direction of Morris Goodkind, bridge engineer, and M. L. Vail, resident engineer. George M. Brewster & Son, Bogota, N. J., was contractor, with the Moretrench Corp., of Rockaway, N. J., doing the drainage work.

LETTERS TO THE EDITOR

Determining Solar Meridian by Stopwatch

Sir—In *Engineering News-Record* of Sept. 10, 1931, p. 420, there appeared an article by James Girand, Jr., entitled "Solar Meridian by Stopwatch." I read this article with considerable interest, as I once made an unsuccessful attempt to derive a short method by similar reasoning.

Mr. Girand arrives at a simple method in formula No. 4, but unfortunately the derivation contains one of those errors that are difficult to avoid in new and untried methods.

In differentiating equation (*2*) it was assumed that the declination D is constant, which is practically correct for polaris and similar bodies and for the sun when it is near either solstice, but which is considerably in error for the sun when it is near the equator. Declination D is a function of t and should be considered as such in equation (*2*). If it were so considered, the resulting equation (*4*) would be more complicated than equation (*1*). R. R. ROBERTSON.

Priest River, Idaho,
Oct. 1, 1931.

Defends Public Engineering Work

Sir:—Your issue of Sept. 17 contained an interesting letter from a Los Angeles engineer, on the subject "Public Work by Private Engineers." It stated that if unemployment relief is to be secured by increased construction of public works the only way that a large enough volume of such work could be handled with sufficient dispatch would be by turning over the projects to private engineers and architects with full power to design, let contracts and supervise construction. The statement is also made that these suggestions apply to city, county and state work, and that in the past city and county engineering departments have taken on a large amount of work more properly belonging to the private engineers.

A casual reader of this letter might think that in Los Angeles the city and county engineering departments are too small to handle an increased volume of work. As a matter of fact, hundreds of engineers in these departments are being laid off and added to the list of unemployed because of the claim put forth by the Los Angeles realty board that there is not enough work to keep them busy. The realty board is interested only in reducing taxes on real estate, and as usual the line of least resistance is to slash engineering departments. A letter such as that mentioned will arouse the suspicion that private engineers are backing the demand for reducing public engineering departments, in the hope that after such departments are sufficiently reduced the authorities may be persuaded to turn over new work to private engineers on the plea that the public departments are too small to handle efficiently a sudden increase in volume of work.

It would be interesting to know what "large amounts of work more properly belonging to the private engineers" have been taken on by city and county engineering departments in the past. There may be difference of opinion as to where such work properly belongs.

Public improvement work in thickly populated communities is a complex problem. Streets, sewers, bridges, water supply, storm drains, grade separations, etc., are all closely related and can not be designed independently of each other. Governmental legislative and administrative bodies constantly call for immediate information or preliminary estimates of cost of some detail of a project under study or design. Interested property owners continually inquire for similar information, all of which is concentrated in a single public engineering department in order best to serve the public.

When and if it can be demonstrated that this work will be handled as efficiently by private engineers as by public engineering departments, then it will be soon enough to discuss whether such a change is desirable. If it is determined that our public improvement engineering would be better handled by private engineers, it follows logically that all corporations that now maintain their own engineering department should disband them as a measure of economy and turn their work over to private engineers also.

Los Angeles, Calif.
Oct. 8, 1931.

W. C. HOGOBOOM.

[*Engineering News-Record* agrees with our previous correspondent in believing that public engineering staffs are not adequately manned to plan the coming winter's work program without extensive help from private engineers.—EDITOR.]

Lowered Groundwater Endangers Foundations

Sir:—The lower section of Manhattan, bounded by Fulton St. on the north, Greenwich St. on the west and William St. on the east, has been practically drained of subsurface water by the several parallel lines of subways, the lines in William, Nassau, Broadway, Church and Greenwich Sts. running north and south, and the cross-lines at Stone, Wall and Fulton Sts. These subways, being at considerable depth below the surface, have honeycombed this area. Naturally any flow of water toward them would cause considerable loss of ground.

After construction there is always ample space for free passage of water along the sides and bottoms due to decay of organic matter incorporated in the fill and to improper tamping. There is also considerable loss of subsurface water by reason of continuous pumping from subway sumps fed by inflow through porous concrete, and further loss through the constant pumping from sumps in subcellars, of which a great many in this area are deep.

Many of the older buildings in this section have wooden pile and timber foundations. This type of foundation has proven its worth, being economical and durable if at all times submerged. If by any chance this preserving bath is drawn off and the foundation is exposed to air, decay soon results. The capillarity of the soil holds a certain amount of moisture in suspension, but also provides a fertile field for spores of decay. It is a question how long it will be before the bearing value of these timber foundations has been so reduced that they can no longer hold the loads for which they were originally designed.

While the front walls and bearing piers adjacent to the new subways have been underpinned, their rear and sides are still jeopardized. Unquestionably many buildings in this area should have their walls resupported by underpinning with either concrete or jacked piles. A survey would probably show an advanced state of deterioration. Some of these older foundations are now being exposed by adjacent deep excavations, affording a good opportunity for investigation. For safety sake this survey should be made and samples of timber taken for study by properly qualified engineers.

MAURICE BLUMENTHAL
and JAMES HAMILTON
Contracting Engineers

New York City,
Oct. 10, 1931

NEWS OF THE WEEK

Federal-Aid Road Money for 1933 Apportioned Among States

Apportionment to the states of the $125,000,000 previously authorized for federal aid in road construction for the fiscal year ending June 30, 1933, has been announced by the secretary of agriculture. The new funds are available to the states for immediate obligation on projected construction. The apportionment has been made 2½ months in advance of the usual date in order that the states may get an early start on plans for next season's construction.

In making the apportionment 2½ per cent was first deducted for administration. The remainder was then apportioned on the basis of area, population, and mileage of rural post roads.

From the apportionment of each state there was deducted one-fifth of the emergency funds apportioned last December. This deduction amounted to $16,000,000, leaving $105,875,000 as the net apportionment available for new projects.

◆

Massachusetts Highway Mixup Goes to Supreme Court

The fight over award of highway contracts in Massachusetts has reached the state supreme court, where a petition was filed on Oct. 15 for a writ of mandamus to compel the governor's executive council to approve or disapprove a contract entered into by the state department of public works and Arute Brothers, Inc., of New Britain, Conn., to construct a section of state highway in the town of Randolph for $51,092. The issue is whether Massachusetts highway contracts can be awarded to bidders outside the state.

The supreme court petition was filed by counsel for Arute Brothers, and asks that the executive council be ordered to act upon the merits of the case without regard to extraneous considerations. The Arute bid was $300 less than that of the next bidder.

◆

Hudson River Bridge to Be Dedicated Oct. 24

Dedication of the new Hudson River Bridge, at New York, will take place on Oct. 24, with appropriate ceremonies. The program as published includes speeches by Secretary of the Navy Adams and the governors of New York and New Jersey, speaking from a point on the span midway between Manhattan and Fort Lee. After the ceremonies on the bridge, which will begin about 3 o'clock and last an hour, the bridge will be thrown open to the general public. The bridge will be opened to traffic on Oct. 25, which is several months in advance of the original schedule.

◆

Another Pipe Line to Be Laid From Kettleman Hills

An additional pipe line 8 in. in diameter and 67 miles long will be constructed by the Standard Oil Company of California along the same route as the present pipe line from the Kettleman Hills oilfield to Estero Bay, near San Luis Obispo. The line will cost $500,000.

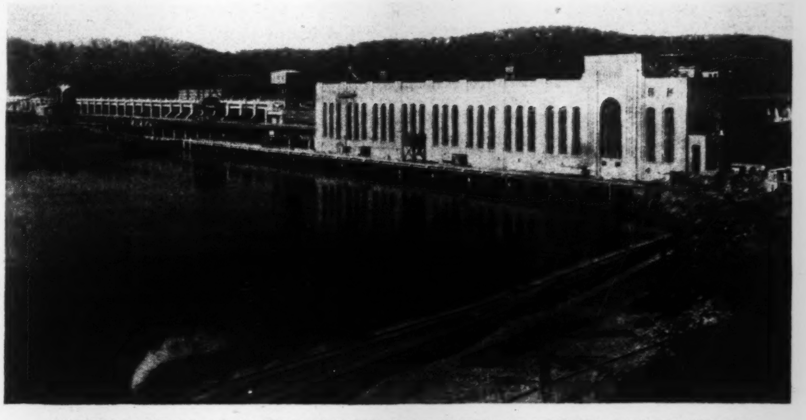
Employment Relief Plans Take More Definite Form

Plans for the relief of unemployed engineers are taking definite shape in Chicago and New York. In Chicago representatives of the Western Society of Engineers and of the local sections of the national civil, mechanical and electrical engineering societies met last week and set up the nucleus of a committee to develop a definite plan for the Chicago region. Similarly at New York the committee appointed by the metropolitan section of the American Society of Civil Engineers has been expanded to include all the metropolitan sections of the Founder societies. This larger group is now organizing its working committees and soon expects to send out a call for contributions.

The planning of both groups is centered around the proposals made to the board of direction of the Am.Soc.C.E. by its committee on salaries, headed by E. P. Goodrich. These proposals were outlined in our issue of Oct. 8, p. 586. More recently the board has sent to all local sections a plea for prompt action in developing a relief program of their own or in assisting in regional relief planning. The board also indorses the plan put out by American Engineering Council.

The Engineering Council plan is directed toward stimulating engineers to assist in general relief-work planning by seeking out work which may be undertaken immediately for relief this winter and in outlining other work that may be included in long-time planning for future emergencies.

◆



SAFE HARBOR WATER POWER PROJECT NEARING COMPLETION

Announcement has just been made that the Pennsylvania Railroad has contracted with the Consolidated Gas, Electric Light & Power Co., of Baltimore, for power to be used on the line now being electrified between Philadelphia, Pa., and Washington, D. C. Much of this current will be supplied by the $30,000,000 hydroelectric development of the Safe Harbor Water Power Corporation on the Susquehanna River, now nearing completion. The initial capacity of this unit will be 250,000 hp., the ultimate capacity 510,000 hp.

Indiana Highway Department Spreads Work by Shortening Day

Hereafter eight hours instead of nine will measure the length of a day for all maintenance forces of the Indiana state highway department. As labor is paid on an hourly basis, the same amount of work will be spread among more men with no additional cost. A. H. Hinkle, maintenance superintendent, in his letter to district engineers and superintendents in 33 cities of the state stresses the importance of obtaining new employees from local relief agencies. The latter, he stated, are to be impressed with the fact that only ablebodied men are capable of doing highway work, since it is hard and subjects the men to severe climatic exposure at times. A few weeks ago the commission absorbed more than 400 miles of county roads into the state system, which has been the means of providing employment in many localities spread widely over the state.

Federal-aid collection by Indiana were far greater this year than ever before. In fact, plans and specifications are now on file with federal engineers for additional projects to absorb $700,000 of federal money, some $170,000 more than so far has been allotted to the state. On Oct. 1 federal money available to Indiana totaled $6,739,400. For the year ended Sept. 30 work had been completed for which the department collected $3,107,000 of normal federal aid and $2,046,000 of emergency money. For paving and bridge contracts shortly to be completed Indiana will collect $3,000,000, leaving a balance of $670,000 not obligated by contracts this fiscal year.

◆

Hoover Dam Notes

As a result of tests made at Denver with the 4,000,000-lb. testing machine, it has been demonstrated that mechanically vibrated and properly ground concrete test cylinders will give higher and more consistent unit strength than hand-rodded cylinders with neat cement caps.

At the dam, tunnel progress to Oct. 10 totals 7,428 ft. of 12x12-ft. pioneer tunnels and 163 ft. of large heading (38 ft.). Pioneer headings haye been holed through between the midway adits and lower portals on the inner diversion tunnels on both sides of the river. The four diversion tunnels will total 16,015 ft. in length when completed.

Eight tons of powder was used to blast away "Cape Horn," a bluff that had to be removed in the construction of the Six Companies' railroad. As a result of this single blast 276,000 cu.yd. of rock was displaced. Out of the 20½ miles of track to be laid 8 miles have been completed. Work is proceeding rapidly on the approaches for the trestle bridge to be built across the river at the gravel deposits, 8 miles up stream from the dam.

Work is progressing rapidly on the gravel plant, which is to be completed in 90 days. It will have a capacity of 500 tons of gravel per hour.

The contract for the filtration and treating plant at Boulder City has been awarded to the Stearns Roger Manufacturing Co., of Denver. The plant is to be completed in 120 days. The same company was awarded the contract for constructing the sewage-disposal plant.

During the week ended Oct. 13, no additional men were employed. The total remains at about 2,600. Of 2,201 men examined by the Six Companies only 101 were rejected for physical disability. An analysis of the force made when it totaled 2,100 men shows that 1,089 of the number are married and that the average age is 34 years. Only 53 are foreigners. Forty-one per cent of the total are ex-service men. Of the total number employed 567 are from California, 253 from Nevada, 120 from Utah, 110 from Arizona and 99 from Idaho. All states in the Union except Vermont and Delaware are represented among the remainder. During the week there was one death caused by a rock fall in one of the tunnels.

Illinois Prevailing Wage Law Held Invalid

The supreme court of Illinois on Oct. 20 by a unanimous decision declared unconstitutional the state prevailing wage law, which by its terms became effective July 1. The law required that in all contracts for public work, including roadbuilding, there shall be a clause requiring the payment by the contractor of not less than the rate of wages prevailing in the community where the work is being done and that the workday shall not exceed eight hours.

◆

S. W. Stratton, First Head of Bureau of Standards, Dies

Samuel W. Stratton, chairman of the corporation of the Massachusetts Institute of Technology and president of the Institute from 1923 to 1930, died suddenly on Oct. 18 at his home in Boston as he was dictating a tribute to the late Thomas A. Edison.

Dr. Stratton was born in Litchfield, Ill., in 1861 and was graduated from the University of Illinois in 1884. From 1885 to 1892 he was connected with the university as instructor in mathematics, later professor, then as professor of physics and electrical engineering. In 1892 he went to the University of Chicago as assistant professor of physics and later became professor, a position he held until 1901, when he was made director of the U. S. Bureau of Standards. In 1923 he resigned to become president of M.I.T.

While he was a teacher of physics Dr. Stratton saw the need for some central department which should have the custody of standards used in scientific investigation. He brought the idea to the attention of Lyman W. Gage, then secretary of the treasury, in 1900. Mr. Gage asked Dr. Stratton to draft the bill for the establishment of what was to become known as the Bureau of Standards and he pressed the matter until Congress acted favorably on the proposal in 1901. Dr. Stratton became the first head of the bureau and by his broad-minded policy made it invaluable to those engaged in the arts and industries of the country.

◆

Fresh Water System Established in Bermuda

The first fresh water system in the history of Bermuda, regarded for centuries as impossible, will be opened for public use on Nov. 30, Prof. W. D. Turner, of the department of chemical engineering at Columbia University, who planned and directed the construction, announces. Drain water, caught on the housetops and frequently polluted to a high degree, has served the residents of the island for generations.

In Bermuda most of the rock is of porous coral, filled with small cavities and fissures. After a survey of island a small hill was selected near Hamilton, capital of the colony, in belief that the fresh water filtering through the rock crevices might be collected. A trench about 250 ft. long and 4 ft. deep was dug at the base of the hill. The bottom of the excavation was about a foot above sea level and sloped gradually to a pump pit.

A pipe line was laid in the trench with open joints so that water might find its way into the pipe and thence to the basin or pit. Concreting the basin, which was dug below sea level, prevented sea water from seeping in. From the collecting basin the water will be pumped into a new reservoir which is practically completed at Pymwood, near Hamilton. From that point the supply will be piped to the capital city and perhaps to St. George's, the old capital, 12 miles from Hamilton.

After the trench was covered over and the basin complete a 2-in. stream was pumped out of the pipe line day and night for three months.

◆

National Safety Council Discusses Traffic Accidents

The profitable uses that can be made of records of highway accidents was the dominant subject discussed at the street and highway section meetings held during the twentieth annual congress of the National Safety Council in Chicago, Oct. 12 to 16. Because of the nature of the subject the section held its meetings jointly with the statistics section.

Up to a few years ago, it was stated by Frank T. Sheets, state highway engineer, the Illinois state highway department found it necessary to devote all its energies to the creation of a system of highways for the state and has but recently been giving attention to a statistical study of highway accident reports. It has already found, however, that such a study serves well to indicate the adequacy of the safety elements included in the road design. It was pointed out that one of the major safety elements in the construction of Illinois highways is the uniformity throughout the state in minimum sight distances, degree of curvature and amount of superelevation. Under these conditions no driver is called upon unexpectedly to deal with unaccustomed travel conditions. Discussion brought out the fact, however, that from 66 to 80 per cent of the total number of highway accidents can be traced to a faulty driver.

◆

Road Builders to Broadcast

Arrangements have been made by the American Road Builders' Association for broadcasting 126 addresses on matters pertaining to highways. These addresses will be made over 42 independent stations. Three talks will be made over each station as follows: Nov. 10, highway safety; Nov. 24, economy of good roads; Dec. 8, roadbuilding for unemployment relief.

Ohio Sewage-Treatment Meeting Attended by 200

Technical problems connected with sewage treatment, plant operation and increased efficiency of disposal plants were major topics on the two-day program of the fifth annual Ohio conference on sewage treatment held in Akron Oct. 13-14. More than 200 engineers, consultants, chemists and others connected with municipal sewage disposal were in attendance.

On the opening day T. C. Schaetzle, of Akron, described the disposal plant at Botzum, near Akron, and R. A. Alton, sewage disposal engineer, of Columbus, talked on "Sludge Digestion." F. W. Jones, of Cleveland, consulting engineer, and C. D. McGuire, chief chemist of the Columbus plant, led discussion on the sludge problem. James R. Collier, engineer in charge of the Elyria sewage plant, gave a description of the plant and its operation and B. F. Hatch, assistant engineer, state department of health, discussed "Trickling Filter Loadings."

On the second day inspections were made of the Goodyear Zeppelin Corp. dock, the U. S. S. "Akron," the Botzum disposal plant and the disposal plant at Elyria.

Water Conditions in Salt River District Best in Five Years

With 372,000 acre-ft. of water already in storage and October streamflow the highest for many years, the Salt River Valley Water Users Association, Phoenix, Ariz., is assured of a 100 per cent supply for the next irrigating season, the first time such a condition has existed for the last five years. The storage now available represents an increase of 212,000 acre-ft. over the water in the reservoirs a year ago and in addition streamflow is correspondingly higher. Assurance of an ample water supply for irrigation in this district will have a marked effect in improving conditions in the territory centering around Phoenix. Present water conditions do not indicate a full supply for the hydroelectric projects of the association.

Denver's Budget Cut $1,000,000 to Aid Unemployment Fund

Municipal administration expenses in Denver, Colo., will be reduced about $1,000,000 next year, but instead of reducing taxes, Mayor Begole announces that the revenue saved will be used in an unemployment relief program to hire more Denver citizens as city laborers.

Standard Specifications for Test Sieves Projected

The standards council of the American Standards Association has approved the initiation of a project to develop standard specifications for sieves for testing purposes (Z23). The American Society for Testing Materials and the U. S. Bureau of Standards have been appointed joint sponsors for the new project.

The organization of a sectional committee, which will include American technologists interested in sieves for testing purposes, is now under way. Specifications for sieves developed by the A.S.T.M. in cooperation with the U. S. Bureau of Standards in 1926 will be used as a basis for the work of the committee. It is expected that this committee will cooperate with the technical committee on sieves for testing purposes of the International Standards Association, looking to the development of an international standard for testing sieves.

NEW BRIDGE IMPROVES HIGHWAY CONDITIONS NEAR SELIGMAN, ARIZ.

Two railway grade crossings, two steep grades and a sharp curve are eliminated by this bridge, completed early this year. The bridge is of concrete, is 514 ft. long and has a 24-ft. roadway. It was built by the Arizona highway department, R. A. Hoffman, bridge engineer, George B. Shaffer, district engineer, and Floyd J. Beeghly, resident engineer in charge of construction.

Economy May Hold Up Many Baltimore Improvements

As a means of keeping down the net debt of the city, recommendations that Baltimore abandon for the present a number of planned improvements have been made to Mayor Howard W. Jackson by his committee on finance. Among the improvements that would be held up are an east-west viaduct, extension of Howard St., new school buildings with the exception of those under construction or planned for immediate construction, new court building and new fire engine houses and police stations.

If the recommendations of the committee are followed, the plan would permit completion of the municipal airport, a new public library and additions to the Baltimore city hospitals, put the conduit extension plan on a pay-as-you-go basis, allow completion of the water-supply extensions and restrict the paving and bridge program.

The committee also recommended that no special election be called for the voters to pass on $22,000,000 in public improvement loans. This total is made up of $10,000,000 for schools, $5,000,000 for paving and bridges, $5,000,000 for sewers, $1,500,000 for conduits and $500,000 for a court building.

Month's Work for 1,300 Men Started in Los Angeles

Jobs have been provided for 1,300 men for at least 30 days by the Los Angeles department of water and power on construction projects started by the department, according to announcement of H. A. Van Norman, general manager and chief engineer. For more than a month 1,000 men will be engaged in enlarging the capacity of tunnel lines between power plants 1 and 2 in San Francisquito Canyon to provide water for an additional generating unit in power plant No. 2. Three hundred men are at work completing the enlargement of the aqueduct capacity to 470 sec.-ft. Funds for this work are supplied from the $38,800,000 water bonds voted in 1930. Funds for work on the tunnel enlargement between the power plants will be derived from power system revenues.

Italy to Spend $45,000,000 on Public Works Next Winter

The Italian government plans to spend about $45,000,000 on public construction for the purpose of relieving unemployment during the coming winter, according to a report received by the commerce department from Trade Commissioner A. A. Osborne at Rome. Of this total, $32,000,000 will be expended on general road maintenance, repairs and improvements by the state highway administration. For repairs and rebuilding in two parts of the country that have recently been extensively damaged by earthquakes slightly less than $2,000,000 will be allotted.

San Francisco's Third St. Bridge Contract Awarded

The contract to build the Third St. Channel bridge, San Francisco, Calif., was awarded on Oct. 9 to Barrett & Hilp, of that city, on a low bid of $552,590. The eight bids received were on a Strauss-type bascule bridge and on plans and specifications prepared by the city. Construction is to be financed jointly by the state and the city. Work will be started within the next three weeks. The contract calls for completion of the bridge nine months after the work is awarded.

On May 18 Barrett & Hilp were awarded the contract for the construction of this bridge on a bid of $644,280, which was not the lowest bid received at that time (*ENR*, June 4, 1931, p. 940). The award was made on this bid because it was the lowest bid on the Strauss-type bascule bridge, which was the type of bridge most adapted to the location. The low bidder, the George Pollock Co., Sacramento, figured on plans for the American Bridge Co. type. Suit was filed in the superior court by the low bidder, claiming that the contract was illegally let. The result was that all bids were rejected and new bids asked.

◆

Highway Bridge Authorized Over Fraser River, British Columbia

The contract for the construction of a bridge over the Fraser River, near its mouth, which will provide a direct arterial outlet from Vancouver to the Pacific Highway at Blaine, Wash., has been awarded to the Terminal Engineering Co., of Vancouver, B. C. The bridge will cross the river over Deas Island, from which it will take its name. It will be a steel structure, 1,117 ft. long, with long timber trestles over tidal flats, and earth embankment approaches. It will have a lift bascule of 300 ft., with a vertical clearance of 160 ft. above high water, and will carry a roadway 30 ft. wide with one 5-ft. walk. The cost is estimated at $3,000,000; financing is complete and work will start within 30 days.

◆

Revetment Wall Planned on St. Lawrence River

Engineers of the Canadian department of public works are drawing up plans for a revetment wall 3 miles in length along the south bank of the St. Lawrence River at St. Lambert, Quebec. The wall will stretch from the extreme western limits of St. Lambert to Victoria Bridge and from Victoria Bridge to the border of Montreal south. Present plans call for it to be built in both directions from the abutments of Victoria Bridge and situated, on the average, 250 ft. farther out than the present shore line.

Straightening Leaning Tower of New Old South Church, Boston

Engineers are reinforcing the foundations of the New Old South Church, Copley Square, Boston, the tower of which inclines toward the southwest about 35 in. The inclination has been increasing at the rate of an inch a year for the past few years and it is the hope of the engineers not only to stop this continuous inclination but to bring the tower back absolutely to plumb. The church is built on wooden piles on a filled-in area, where the tide ebbed and flowed up to about 1870. The church was erected in 1875.

Willis A. Slater—*An Appreciation*

The death on Oct. 5 of Willis Appleford Slater, research professor of engineering materials and director of the Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa. removed from the field of structural engineering research one of its leading workers. In the field of investigations relating to concrete he occupied a high place beside his veteran teacher, A. N. Talbot. His indefatigable labors during the past 25 years and his many papers and reports have contributed largely to our growing knowledge of concrete and form part of the basis of present practice in construction and design.

W. A. Slater

Willis A. Slater was born in 1878 in Polo, Ill. and was educated at the University of Illinois (1906). After two years in municipal engineering work he returned to the University of Illinois and joined the group of research workers who, under the leadership of Prof. Talbot, were then well on their way with those contributions to engineering science which have helped to make famous the engineering experiment station at Urbana. Slater remained with this group until 1917, giving his efforts to experimental investigations in reinforced concrete. During this period he was active in those pioneer strain-measurement studies of reinforced-concrete buildings under load which have served as the basis of present design specifications. The spirit of these days has been well given by Arthur Lord (in the June, 1931, *Journal* of the American Concrete Institute):

> How much would concrete have lost in leadership were it not for Prof. Talbot's atelier at Urbana! There, for many years, Slater perfected his powers of analysis and matched wits and witticisms with Moore, Abrams, Wilson, Hollister, Richart and a host of other keen young research workers, instructors and graduate students. He shivered through wintry midnights on the early tests of actual stresses in concrete buildings. On other, more comfortable midnights be began his immense output—I doubt if anyone has ever exceeded it—of bulletins and papers and reports relating to the testing and design of concrete; all prepared with reckless expenditure of time, effort and thought . . . . The Talbot tradition did not countenance loose thinking, nor partial data, nor careless composition.

When the war came, in 1917, Slater joined the Bureau of Standards and was placed in charge of the structural laboratory investigations in reinforced concrete for the concrete ship section of the Emergency Fleet Corporation. From this work came several highly important papers, one of which won him the Wason medal of the American Concrete Institute.

After returning to the Bureau of Standards, in 1921 he joined with Prof. H. M. Westergaard in writing the famous paper on "Moments and Stresses in Slabs," probably the first presentation to American engineers of the mathematical theory of flat slab action (this by Prof. Westergaard) and its correlation with test results. In 1923-24 he was absent on leave to assist his alma mater in the construction of its $2,000,000 stadium. For two years (1925-27) he was again on leave from the bureau taking charge of the tests on the Stevenson Creek experimental arch dam.

In 1928 Slater realized his life ambition. He then came to Lehigh University as director of the Fritz Engineering Laboratory, and so found himself in control of a large, well-equipped plant, a fit instrument for his abilities. Here and at the University of Illinois proceeded the investigation of reinforced-concrete columns of the American Concrete Institute, which is now nearing completion. Slater, as chairman of the committee in charge, had general control and direction of all the work, which already is revolutionizing our conception of the action of reinforced-concrete columns and will also revolutionize methods of design.

A typical story is told which illustrates his keen mind and his charming whimsicality. With a friend he was driving through the country and they passed a field where many sheep fed. "Look!" said his friend, "those sheep are all black." "Well, perhaps," came the reply. "They are black on *one* side anyway." Those who knew Willis Slater came to love him for his friendly, unassuming ways, his quiet humor, and to admire him for his rigor and fairness in technical discussion and for his spirit of scientific tolerance. His death brings great loss to the university he served, to his profession and to his many friends.

Hale Sutherland.
Lehigh University.

Brief News

Plans for the development of piers, wharves, slips, warehouses and other facilities at Gulfport, Miss., to cost about $1,000,000 and to be financed by the state and the city of Gulfport will be presented before the next session of the state legislature in January.

New Library and science buildings will be erected at the University of Arkansas, Fayetteville, plans having been recently approved by the board of trustees. The buildings have been authorized by the legislature and will cost about $725,000. The money will be raised by a tax on cigarettes.

Construction of a fixed dam at Montgomery Island in the Ohio River about 31½ miles below Pittsburgh, Pa., at an estimated cost of $6,000,000, to replace three movable dams has been authorized by the war department. The new dam will have roller gates and double lock chambers.

Construction Contracts for the Chicoutimi bridge in the Province of Quebec have been awarded by the provincial government. The contract for the steelwork was let to the Eastern Canada Steel & Iron Co. for $350,000. The general construction contract was awarded to A. Janin & Co., Ltd., of Montreal for $308,168.

Contracts have been let for part of the new bridge which is to link the Island of Orleans with the mainland, in the Province of Quebec. The St. Lawrence Engineering & Construction Co., Ltd., received the contract for the paving and foundation of the north and south sections for $605,300, and Eastern Canada Steel was given the contract for the steelwork of the same sections for $298,700. The contract for the middle span will be awarded later.

A Hydro-Electric Power Station of unusual type has been constructed at Kremnitz near Pressburg, Czechoslovakia. In an abandoned coal mine two turbines of 3,600 hp. each have been set up 800 ft. below the surface and a small river has been diverted into the mine to supply the generators. The water passes off through the mine through caves and underground passages.

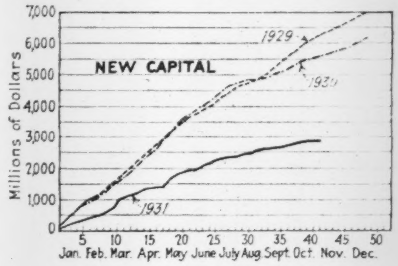
To Aid Unemployment, a new federal census of Montreal has been suggested following revelation of discrepancies alleged to exist in the recent official census. It is proposed to have unemployed workers used as census takers.

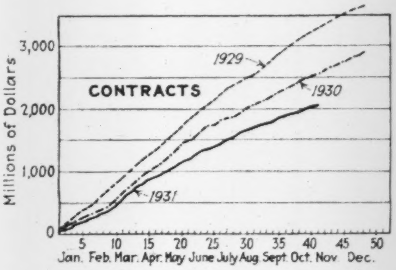
Fish-Frying as a public nuisance seems to be a problem for sanitary inspectors in England. In response to an inquiry from an inspector, an article is published in *Municipal Engineering* (London) on fish-frying ranges, operated by gas, "which comply with the most stringent and exacting sanitary and hygienic requirements."

Capital and Contracts

Not since the week which ended Oct. 3 has any new capital been issued for purposes of construction. In the week of Oct. 17 no new bond issue of any kind was offered, marking the first occurrence of the sort since the war.

The total thus far this month remains at $23,000,000, compared with $244,000,000 for the first three weeks of September and $234,000,000 for the corresponding period in October, 1930.





The cumulative total for Jan. 1 to Oct. 17, inclusive, is $3,069,000,000 compared with $5,434,000,000 for the same period in 1930.

◆

Mississippi Channel Improvement Work Simplified

Effective Sept. 15 channel improvement on the Mississippi River was divided into three sectors, each comprising a major river system, by order of Col. George R. Spalding, division engineer in charge of channel improvement. The order, which has been approved by Major Gen. Lytle Brown, is a step in the movement inaugurated by President Hoover to simplify supervision of river improvements.

Channel work on the Mississippi River between the Illinois and Ohio rivers and the Missouri River will be included in a Missouri-Middle Mississippi sector under Lieut. Col. R. C. Moore as sector engineer at Kansas City.

The Illinois-Northern Mississippi sector, comprising the upper Mississippi and Illinois rivers system to Chicago and the Great Lakes, will have sector headquarters at Davenport, Iowa.

The Ohio River sector, comprising the Ohio River and tributaries in six army engineer districts, will have headquarters at Cincinnati under Lieut. Col. R. G. Powell.

For the time being Col. Spalding will be in charge of the Illinois-Northern Mississippi sector.

WASHINGTON NOTES

By PAUL WOOTON

Washington Correspondent

Union Wage Rates to Prevail on Construction Work on Miami Post Office, Secretary of Labor Rules

As other government departments are taking cognizance of protests against wage cuts by contractors of federal work, the secretary of labor has invoked his power under the Bacon-Davis act a second time and has determined the rate to be paid workers on the post office at Miami, Fla. In this case, as in the first instance, Secretary Doak decreed that union rates shall constitute the prevailing rates. It was protested that the contractor on the job was paying less than the wage scale existing in the city and that he was importing cheap labor from other communities. The rates fixed by Secretary Doak are from 35c. an hour for common labor to $1.50 an hour for skilled tradesmen.

Meanwhile the Bureau of Public Roads has announced that it will permit state officials to set a minimum rate for common labor in letting contracts for federal-aid highways. Gen. Brown, Chief of Engineers, has indicated that he will permit engineer officers in charge of flood-control and river and harbor work to require the maintenance of wages above a specified minimum on contract work. As the result of the work that they do directly by means of day labor, the army engineers are particularly well qualified to determine whether or not a contractor is paying a fair rate, Gen. Brown believes.

Louisiana Residents Seek to Enjoin Levee Board Tax Collection

Claiming that the assumption by the federal government of responsibility for the flood-control project has rendered unnecessary levee construction work by local agencies, residents of Avoyelles Parish, La., have asked the courts to enjoin the collection of taxes for the levee board. Unable to secure a restraining order from the state court, the property owners have appealed the case to the U. S. supreme court. This court has now agreed to review the case.

In submitting the matter to the courts the land holders contend that the flood-control act supersedes all plans by state agencies for constructing flood-protection works in the territory included in the act. It so happens that the levee for the construction of which the protested assessment was being made would lie directly across the path of a spillway that the army engineers intend to build through the section. A clause of the flood-control act prohibits the construction of levees in the alluvial valley of the Mississippi unless such structures are recommended by the Chief of Engineers and are authorized by the secretary of war.

Salt Waste Water From Oilfields Contaminates Domestic Supply

County engineers and health authorities of Orange County, Calif., have been asked to make an investigation of the pollution of the county's domestic water supply by filtration of salt waste water from the oilfields of the Huntington Beach area into the fresh water strata. W. R. Osborn, president of the Huntington Beach Chamber of Commerce, requested the investigation as a step toward protection of new wells in and near Huntington Beach from which uncontaminated water is being produced.

Seepage of salt water into the subterranean fresh water channels has been so pronounced, it is stated, that all wells adjacent to the Huntington Beach oilfield have been abandoned and several wells nearly half a mile from the field have recently been contaminated by salt water. It is stated to be the belief of Huntington Beach residents that the salt water does not come from the ocean but is the waste salt water from oil wells.

◆

Contract Let for New Fresh Water Intake for Toronto

A contract has been let to the Foundation Company of Canada for the submerged fresh water intake on Lake Ontario for the city of Toronto. This work consists of sinking a compressed air caisson 3,300 ft. from shore to meet a tunnel that has been driven that far. Steel pipe incased in concrete is to be laid in an excavated trench from the shaft 4,250 ft. farther out into the lake. The depth of water is about 50 ft. Each section of pipe is 100 ft. long and weighs 250 tons. Special marine equipment is required for this work. Actual operations will be started early in the spring of 1932 and the work is to be completed by the fall of 1933.

COSTS AND CONTRACTS

ENR Index Numbers

Cost		Volume		
Oct. 1, 1931	**169.78**	**Sept.,**	**1931**	**225**
Sept. 1, 1931	171.40	August,	1931	187
Oct. 1, 1930	198.72	Sept.,	1930	232
Average, 1930	202.85	Average,	1930	260
Average, 1929	207.02	Average,	1929	317
1913	100.00	1913		100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Oct. 22, with some comparisons, total as follows:

(In Thousands of Dollars)

	Oct. 22,	Average of Last Four Weeks	
Buildings:	1931	1931	1930
Industrial	$1,645	$4,409	$5,139
Other	63,504	24,196	23,380
Streets and roads..	4,329	6,224	9,908
Other construction.	6,878	12,889	11,050
Total	$76,356	$47,719	$49,478

Total, all classes, Jan. 1 to Oct. 22:

1931	$2,155,992
1930	2,766,085

Personal Notes

William M. Johnstone, vice-president and general manager of the Stanley Construction Co., of Hamilton, Ont., has been appointed assistant commissioner of works of the city of Ottawa. Mr. Johnstone, who was chosen from a list of 80 applicants, has done work as engineer for the cities of Toronto and Hamilton.

Norman F. Brown, director of public works of Allegheny County, Pa., since 1924, has resigned because of ill health. Mr. Brown intends to return to private engineering practice.

Raymond Swenk, superintendent of the Philadelphia Terminal division of the Pennsylvania R.R., has been promoted to general superintendent at Chicago. Mr. Swenk is a civil engineering graduate of Pennsylvania State College and has held a succession of positions from rodman to division engineer at various points in Pennsylvania, and in 1927 was made superintendent of the Erie and Ashtabula division. He went to Cleveland as superintendent of the Cleveland division in 1929 and last January was transferred to Philadelphia.

N. W. Brown, locating engineer of the Missouri-Kansas-Texas Lines, has been appointed industrial engineer for the railroad, with office at St. Louis, Mo.

B. J. Young, of New Rochelle, who has been park commissioner and resident engineer in New Rochelle for the Westchester County Park Commission since 1925, has been advanced to the post of commissioner of public works, succeeding Samuel J. Garges.

Ralph E. Simpson, chief clerk in the state highway department of Indiana, has been named assistant director. Mr. Simpson joined the engineering staff of the department in 1919 and became chief clerk in 1929.

James N. Gladding has been appointed city manager of Albuquerque, N. M., to fill the vacancy caused by the resignation of R. L. Cooper. Several years ago Mr. Gladding served as city manager for two years.

SOCIETY CALENDAR

AMERICAN INSTITUTE OF STEEL CONSTRUCTION New York City; annual meeting, White Sulphur Springs, W. Va., Oct. 28-30.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; annual meeting Jan. 19-22, New York City.

ASSOCIATION OF WESTERN STATE ENGINEERS, fourth annual conference, Sacramento, Calif., Oct. 28-30.

NATIONAL MUNICIPAL LEAGUE, New York City; annual meeting, Nov. 9-11, Buffalo, N. Y.

CENTRAL STATES SECTION, American Water Works Association, met in its 33d annual convention Oct. 8-9 in Cincinnati. Many papers on practical questions of waterworks operation and maintenance were read and discussed. Officers of the section for next year are: chairman, Albert S. Hibbs, Cincinnati; vice-chairman, George Whysall, Marion, Ohio; secretary-treasurer, B. J. Lechner, Erie, Pa. The 1932 convention will be held in Erie, Pa.

INTERNATIONAL CITY MANAGERS ASSOCIATION, meeting in Louisville, Ky., Oct. 7-10, elected officers as follows: president, Charles A. Carran, East Cleveland, Ohio; first vice-president, George Fairace, Fort Worth, Tex.; second vice-president, P. P. Pilcher, Winchester, Va.; third vice-president, C. A. Harrel, Portsmouth, Ohio.

IOWA SEWAGE-TREATMENT CONFERENCE will be held Nov. 18-20 at Iowa State College, Ames, Iowa. The increasing seriousness of stream pollution, the urgency of sewage treatment and effective operation of plants are subjects on the program. The engineering extension department of the college is sponsoring the conference.

SECTION MEETINGS, American Water Works Association, are scheduled as follows: Minnesota, at St. Paul, Oct. 30-31; Missouri Valley, at Lawrence, Kan., Oct. 29-31; North Carolina, at Greensboro, Nov. 2-4; Wisconsin, at Racine, Oct. 26-27.

SOCIETY OF INDUSTRIAL ENGINEERS, at its convention in Pittsburgh, Oct. 14-16, issued a call to the entire engineering profession to take the lead in spreading knowledge of planning. "We believe that the ultimate cure for recurrent depressions will be found only in such orderly foreseeing of events and provision for the future as the engineer has learned to apply to business," it was declared. Officers were reelected, as follows: president, John M. Carmody, editor, *Factory and Industrial Management*; executive secretary, George C. Dent, Chicago; treasurer, E. A. Rummler, Chicago.

Obituary

Alfred Lawrence Kehoe, consulting structural engineer, died in New York City on Oct. 17. He was born in New York in 1889 and after attending Columbia University was for a time employed by the American Bridge Co., but in 1909 he entered the engineering office of H. G. Balcom, continuing in that work until his death. For the past twelve years he had been a partner. During his career in structural engineering he was connected with the design of the steel framework of many of the largest buildings in New York and elsewhere.

R. F. Carr, president of the R. F. Carr Construction Co., of Memphis, Tenn., was killed in an automobile accident on Oct. 9 near Arlington, Tenn. Mr. Carr, who was born in Montgomery, Ala., 55 years ago, was first with the Southern Railroad and later with the Frisco Lines as superintendent. He was the contractor for rebuilding and ballasting the Frisco Lines between Kimbrough, Ala., and Pensacola, Fla.

John Sayre Cox, 78 years of age, civil engineer and chemist, died at his home in Buffalo, N. Y., on Oct. 13. Mr. Cox was one of the few survivors of the Collins expedition to Brazil in 1877, when the original attempt was made to build the Madeira & Manore Ry. Later Mr. Cox joined a company of engineers who went to Mexico in 1886 and constructed the Mexican National Railway. After returning from Mexico he entered the employ of the Bethlehem Steel Co. and later served the old New York State Steel Co. and the Pierce-Arrow Motor Car Co.

Construction Equipment and Materials

Chart Solves Slope Problems

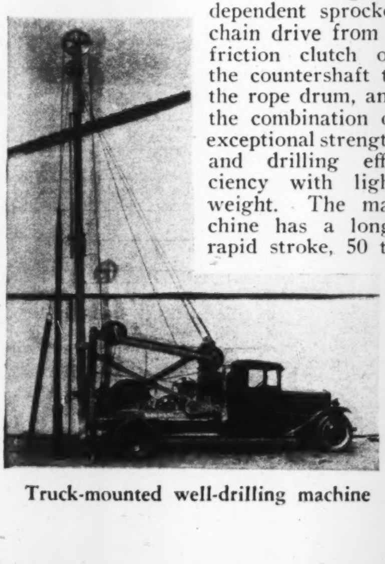
In an effort to simplify the solution of engineering problems involving bevels, slopes, rises, bases and clearances, the Engineering Devices Co., 1234½ South Plymouth Blvd., Los Angeles, Calif., is marketing Bregman's Mono-Chart, which gives simultaneously: (1) the bevel, slope, rise and base for any angle between 0 and 45 deg.; (2) working distances required for clearing structural members framing at angles between 0 and 45 deg.; and (3) the angle corresponding to any given bevel. The chart is 9x12 in., consisting of a cardboard base on which is mounted a swinging top sheet of tracing cloth. Full directions for operation are printed thereon.

◆

Well Drilling Machine for Light Truck Mounting

Because the sinking of groundwater levels in recent years has made necessary the deepening and repair of many water wells, the well driller finds that an increasing part of his business consists of small jobs rather widely separated. The outstanding requirement in a modern well-drilling machine, therefore, is rapid portability. Thirty years ago a drilling machine for 500-ft. depths weighed, exclusive of tools, 13,000 to 14,000 lb. with traction mounting. A new No. 70 well drill now offered by the Keystone Driller Co., Beaver Falls, Pa., weighs 4,800 lb. without the truck mounting. It is designed for carriage on a 1½-ton Chevrolet or Ford truck, with long wheelbase and dual pneumatic tires.

Novel features of the new machine are the telescoping pipe derrick, all-steel riveted framing, independent sprocket chain drive from a friction clutch on the countershaft to the rope drum, and the combination of exceptional strength and drilling efficiency with light weight. The machine has a long, rapid stroke, 50 to 60 strokes per minute, and a depth capacity of 300 ft. with manila line and 600 ft. with wire drilling cable. It is powered with a 16-hp. four-cylinder Waukesha engine and will carry 1,400 lb. of drilling tools. For light blast-hole and test boring the rig can be mounted on four iron wheels with a drawbar for attachment to a tractor.

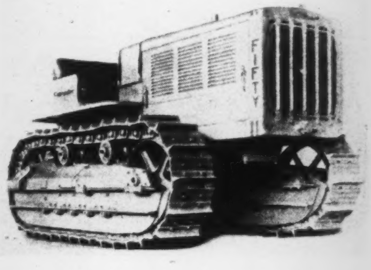


Truck-mounted well-drilling machine

◆

New Size Added to Tractor Line

Filling an important gap in the present line of Caterpillar Tractor Co., Peoria, Ill., a new tractor has been announced which develops 50 maximum drawbar horsepower and 57 hp. maximum belt horsepower. In general appearance, the new Caterpillar 50 resembles smaller units made by the company; it has a hood inclosure for the engine, a fuel tank just behind the engine, a wide, cushioned seat for the driver, and all controls conveniently placed within easy reach. The transmission has four speeds forward and one reverse, with a maximum forward speed of 4.7 m.p.h. Gage, center to center of tracks, is 60 in.; ground contact area, with standard track shoes, 2,456 sq.in.; length, 146¼ in.; height, 75¾ in.; width, 75⅞ in. The motive power is a four-cylinder, four-cycle, water-cooled valve-in-head gasoline motor with a bore of 5½ in. and a stroke of 6½ in. The same items of special equipment available for the models 60 and 30 will also be available for the Model 50.

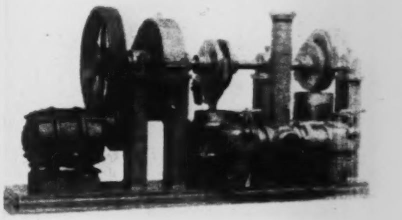


50-Hp. crawler tractor

◆

Change in Operating Mechanism Improves Sludge Pump

By changing the operating mechanism of the Marlow plunger sludge pump while retaining the same pump body, valve chamber, plunger and other parts which have been used for years, Marlow Pumps, Ridgewood, N. J., has produced an improved unit which is now being offered through the Pacific Sludge Tank Co., Chicago and New York City. Simplex and duplex types have 4-in. inlets and outlets; the triplex type is fitted with 6-in. inlets and outlets. Capacities are variable, being adjustable from 0 to 75 gal. per minute per plunger by means of new type eccentrics provided with shear pins so that a sudden stoppage of the line, or a piece of foreign material under the plunger, will shear the pin and protect the pump against damage. The shear pin is an ordinary 8-penny steel nail obtainable at any hardware store. Other features of the pump include a new all-steel electrically welded frame, fully inclosed Hyatt roller main bearings, and fully inclosed noiseless gearing, running in oil.



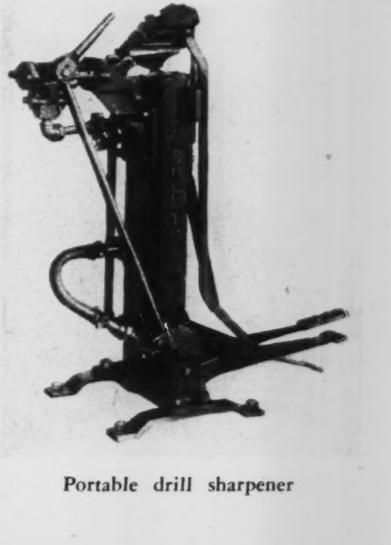
Duplex sludge pump with V-belt drive

While this pump is designed primarily for handling heavy sewage sludges, it can also be used for slaughter-house and tannery wastes and similar liquids.

◆

Light Drill-Sharpening Machine

In order to bring the advantages of mechanical sharpening and dressing of rock drill and hammer drill steel to contractors, quarries or public-works departments that have hitherto depended on blacksmiths because of the small amount of work necessary, or price and weight limitations with present sharpening equipment, the Sullivan Machinery Co. has introduced its Class E sharpener, equipped to do such work with precision and quality equal to that of larger Sullivan machines but weighing only 350 lb. This machine occupies a floor area



Portable drill sharpener

only 18 in. square and stands just over 4 ft. in over-all height. It operates satisfactorily without any foundation other than that provided by bolting to the floor or light timbers. The portability of the new sharpener makes it possible to keep it right up with the rock-drilling tools and portable air compressor. It employs the well-known Sullivan all-hammer principle, its upsetting and vertical hammers being operated by compressed air. Steel is held in the clamp by a foot lever and toggle which permit rapid action and provide a secure and positive grip. The sharpener is very economical of air, and can be operated from a portable compressor without pulling down the pressure at other tools. It will make cross or rose bits to 2½ in. maximum gage on ⅞- or 1-in. steel and will forge collar shanks. Dies are made for any steel section. In addition, the machine can be used to sharpen concrete breaker, pick or chisel bits on steel as large as 1⅛-in. hexagon.

◆

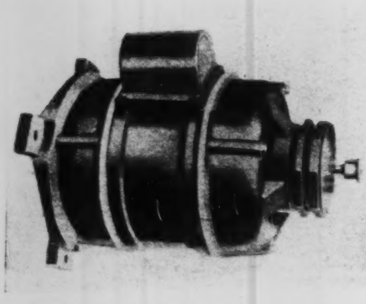
New 1½-2 Ton Motor Truck

Suitable for a wide variety of purposes, a new low-priced truck in the 1½- to 2-ton range, powered with a six-cylinder 60-hp. motor and known as model T-18, has been announced by the General Motors Truck Co., Pontiac, Mich. Body lengths of 9 or 12 ft. are made possible through the use of two wheelbases, 131 and 157 in., while dual wheels are offered as optional equipment. Motive power is provided by a six-cylinder, 60-hp., L-head type motor, made vibrationless through use of a heavy crankshaft which is not only dynamically and statically balanced but counterweighted and equipped with a harmonic torsional balancer. Protection against freezing is assured by the use of a flat tube and fin type radiator. In this type, when freezing occurs the tubes expand into cylindrical form instead of bursting.

◆

Electric Motor Adjustable While in Operation

An electric motor, the rotor of which can be adjusted while in service through the use of a special device built into the shaft, is now obtainable in the standard line of Red Band Motors manufactured by the Howell Electric Motors Co., Howell, Mich. The shaft adjustment is attained through a cast-steel housing accurately machined with sixteen threads per inch. By placing a wrench on the micrometer adjustment, a meter on a connected pump and an ammeter on the motor, it is possible to obtain the maximum pump capacity and motor efficiency in a few minutes with the motor in operation. As the lubrication chamber of the motor is totally inclosed at all times while the adjustments are being made, there is no possibility of injurious materials entering the housing or ball bearings.

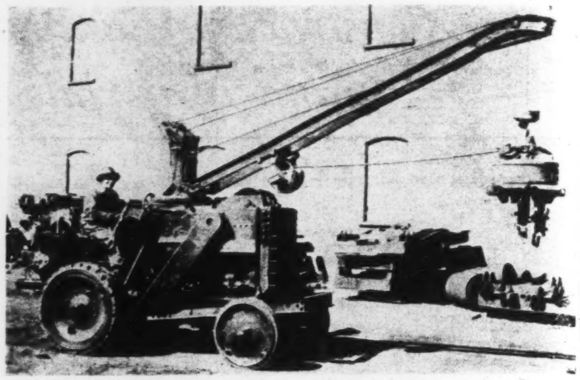


Adjustable shaft motor

◆

Magnet Fitted to Small Crane

The Loadmaster crane, manufactured by the Bucyrus-Erie Co., South Milwaukee, Wis., and mounted on either wheels or crawlers, may now be obtained equipped with a 20-in. Ohio magnet for handling scrap iron and small castings which ordinarily require considerable time for hooking. Since the Loadmaster requires no more space for operation than a small automobile, has a full-revolving boom and can lift and travel with its load, it forms a convenient unit for industrial plants whose material-handling problem has not warranted the purchase of a larger machine. Power is supplied to the magnet by a 2-kw. Kohler electric plant mounted on the truck frame of the crane.



Tractor-crane equipped with magnet

New Publications

Reinforcing Bars — Simplified practice recommendation R 26-30, covering eleven standard sizes of steel reinforcing bars with areas expressed to two decimal places, has been published by the U. S. Bureau of Standards. Copies may be obtained from the Superintendent of Documents, Washington, D. C., at 5c. each or from the Concrete Reinforcing Steel Institute, Tribune Tower, Chicago, Ill.

Design Data—"Hydraulic Tables and Other Data" is the title of Bulletin 25, published by the Baldwin-Southwark Corp., Philadelphia, Pa. This contains 32 pages of tables and charts useful to the engineer engaged in the design or use of hydraulic equipment, particularly those structures involving the use of hydraulic pressures for load-producing purposes.

Culverts—Ease and speed of installation, economy, full-width roadway and durable maintenance-free service are listed as advantages following the use of large-diameter culverts in replacing small bridges in a new catalog 8 "Armco Large Diameter Corrugated Pipe," issued by the Armco Culvert Mfgrs. Assn., Middletown, Ohio.

Highway Equipment — Recent bulletins published by the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, Ill., deal with snow plows for motor truck mounting (W-31-K); the Badger 11-ft. tractor shovel (1236); the Model 101 leaning wheel grader (1238); and the Model 77 six-cylinder dual drive motor grader (1239).

Sewage Treatment—An interesting booklet describing the mechanically operated activated sludge sewage disposal plant at Providence, R. I., has been prepared by the Dorr Co., 247 Park Ave., New York City, for distribution among members of the New England Sewage Works Association who inspected the works on Oct. 19. The new plant replaces one of the chemical precipitation type built 35 years ago.

Burned Clay Building Units — Haydite Manufacturers' Assn., Kansas City, Mo., recently published a data book for architects and engineers setting forth in detail the advantages and fields of use for building units made of its lightweight "expansively" burned clay or shale aggregate. General properties of Haydite aggregate and Haydite concrete are given, together with the various dimensions, weights and characteristics of the building units. Haydite acoustical walls, Haydite floor systems, roof tile and other building specialties are considered. The book concludes with two pages of photographs and data referring to the use of Haydite concrete in the structural field.

Pulling Machines—Puljack and Puljack, Jr., hand-operated pulling machines weighing only 198 and 46 lb., respectively, and developing straight-line pulls of 15 and 5 tons, are described in two 4-p. leaflets issued by the Puljack Mfg. Corp., 98 Pine St., New York City.

Hoist Safety—Safety suggestions for the protection of workmen on hoists are given in considerable detail in a 12-p. illustrated bulletin 12 issued by the committee on accident prevention of the Building Trades Employers Assn., 2 Park Avenue, New York City.

Rubber Goods—A new edition of the mechanical catalog of the Diamond Rubber Co., Inc., Akron, Ohio, is ready for distribution. New items include rotary drillers' hose and packing.

Trucks—Reo Motor Car Co., Lansing, Mich., has prepared a celluloid slide rule for calculating the number of gross pounds of load that the Reo Gold Crown engine is capable of pulling under varying conditions.

Welding and Cutting Torches—Torchweld Equipment Co., 224 North Carpenter St., Chicago, Ill., has a 32-p. pocket size catalog giving detailed information on welding and cutting torches, gas-pressure regulators and auxiliary equipment.

Excavator—The new 42-B 1½-cu.yd. electric shovel-dragline-crane-clamshell is described in a 20-p. illustrated bulletin issued by the Bucyrus-Erie Co., South Milwaukee, Wis. Working ranges and specifications are included.

Graders — The Caterpillar 20 leaning wheel grader and 60 elevating grader with engine belt drive are described in two recent bulletins of the Caterpillar Tractor Co., Peoria, Ill.

Treated Timber—Uses of lumber pressure-treated by the ZMA process are described and illustrated in a bulletin prepared by the Curtin-Howe Corp., 405 Lexington Ave., New York City.

Bituminous Pavement—A 16-p. bulletin telling of the advantages and giving specifications for the use of Pre Cote bituminous coated aggregates for paving has been issued by the Pre Cote Corp., Continental Bank Building, Indianapolis, Ind.

CONSTRUCTION NEWS

CONTENTS

Engineering Structures: Page
Airports 154
Bond elections 152
Bridges 149a
Dams 154
Equipment 155
Excavation 152
Federal Government 152
Foreign 155
Grade Crossings 153
Heating and Ventilating 154
Materials 154
Parks and Sports 154
Piers and Wharves 154
Power and Lighting 154
Railways 153
Sewers 149a
Streets and Roads 150
Subway and Tunnels 153
Waste Disposal 149a
Waterworks 149
Unclassified 154
Industrial Buildings:
Factories and Mills 157
Garages 157
Power Plants 157
Warehouses 157
Commercial Buildings:
Banks 156
Churches 155
Clubs 155
Hospital 155
Offices 156
Public 156
Residential 155
Schools 155
Stores 156
Theaters 156
Unclassified 157

Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	*Project*	*Cost*	*Status*
Waterworks			
Napa (Calif.)	Dam	$1,000,000	Surveys
Pasadena	Dam	5,770,000	Proposed
Sewers			
Denver	Sewer	4,000,000	Proposed
Sports and Parks			
McKeesport (Pa.)	Memorial Park	1,000,000	Proposed
Unclassified			
Cleveland	Mausoleum	1,000,000	Proposed
Federal Government			
Los Angeles	Federal	5,650,000	Proposed
Midland (Pa.)	Lock and dam	2,000,000	Proposed
Factories and Mills			
Youngstown (O)	Pipe mill	1,500,000	Proposed
Texas City (Tex.)	Oil refinery	1,000,000	Surveys
Buildings			
Indianapolis	Library	1,000,000	Proposed
Boston	Office	1,500,000	Proposed
New York	Theatre, etc. Radio group	50,000,000	Contract
Hamilton (Ont.)	Railroad station	3,000,000	Bids asked
New York	College, library	3,500,000	Contract
Montreal (Que.)	Hospital	1,500,000	Proposed

WATERWORKS

PROPOSED WORK

Ala., Cornelia — New waterworks. $75,000. Robert & Co., Bona Allen Bldg., Atlanta, Ga., engrs.

Calif., Hillsborough—Hillsborough Water Co., 58 Sutter St., San Francisco, installing filtration plant.

Calif., Long Beach—For 2.75 mi. 24 and 30 in. and 0.5 mi. cent. concrete pipe line in Spring St. J. B. Lippincott, Petroleum Security Bldg., Los Angeles, engr.

Calif., Long Beach—For 93,000 cu.yd. excav. and preparation founds. for 6 steel tanks. $32,500. J. R. Lippincott, Petroleum Security Bldg., Los Angeles, engr.

Calif., North Sacramento (Sacramento P. O.) C. Knight city engr., making surveys installing pumps, water line, hydrants, for municipal water works. $60,000 or more.

Calif., Pasadena—City Council takes bids sometime before Jan. 1, constructing 93,000 cu.yd. concrete required to bring found. of Pine Canyon Dam in San Gabriel Canyon, 4 mi. above Azura, to level of stream bed, 450,000 cu.yd. concrete will then be required on gravity type superstructure which will rise 265 ft. about stream bed and be 750 ft. long at top. Preliminary work, incl. 550,000 cu.yd. earth loose rock, sand and gravel exca., will be done by hand labor, starting at once. Total $5,770,000. C. E. Piierce, S. B. Morris, ch. engr. City Hall, Noted July 2.

Calif., Sacramento—Pumps, motors for pretreatment works at municipal filtration plant, two 25, m.g.p.d. and two 20 m.g.p.d. pumping plants. F. J. Klaus, city engr. Noted Aug. 20.

Ill., Moline—City Council waterworks improvements, incl. reservoir, purification system, new connecting mains, $350,000. Pearse, Greeley & Hansen, 6 North Michigan Ave., Chicago, Ill., engrs.

Mass., Wakefield—Town, M. Merrill, supt. Water Dpt., waterworks, incl. 15 driven wells, pumping station. Westson & Sampson, 14 Beacon St., Boston, engrs. Noted Mar. 5.

Pa., Munhall—Boro, L. Y. Woodward, secy., pumping station, incl. pumps, motors, piping. $25,000. F. B. Shafer, Municipal Bldg., engr.

Wis., Menominee Falls—City Council, pumphouse, equipment, incl. storage reservoir, deep well turbine pump, centrifugal booster pump, automatic control. $20,000. P. L. Clark, 207 West College St., Appleton, engr.

Wis., Oconto—City Council, purchasing water plant and plans installing new equipment and electrification entire plant. $60,000. Engineer not appointed.

Ont., Bronte—Water Comn. waterworks extension, incl. new intake, filter beds, pump house, water-mains, valves, hydrants. $100,000. G. H. Powers, 53 Brant St., Burlington, engr.

Ont., Harrow—Town Council, preliminary plans waterworks $56,000. Maturity this winter. J. H. Madill, town clerk. Engineer not appointed.

Ont., Overbrook — C. H. Guest, twp. clk., Billings Bridge, soon takes bids new waterworks. $45,000. W. L. Cassels, Banque Natl. Bldg., Ottawa, engr.

Ont., Overbrooke—Town waterworks $62,000. J. L. Jones, Overbrooke, town reeve. W. L. Cassels preparing plans.

Ont., Toronto—For 1 mi. c.i. main in Ellerbeck Ave. from Danforth to Browning Aves. $63,360. R. C. Harris, City Hall, engr.

BIDS ASKED

Calif., Sacramento—Oct. 29, by H. G. Denton, city clk., rein.-con. sedimentation basins for filtration plant. $250,000.

Conn., Rocky Hill—Nov. 2, by Rocky Hill Incorporated District, C. E. Holmes, pres., 450,000 gal. steel standpipe, 30 ft. diam., 85 ft. high with roof and concrete found. adv. E.N.-R. Oct. 22.

Calif., Long Beach—See "Streets and Roads."

Ind., Fairmount—Town Bd. taking bids furnishing, laying 6 in. mains. $15,000. J. R. Little, Fairmount, clk. Noted Aug. 6.

Ind., Speedway—Oct. 28, by Bd. Town Trustees, Speedway State Bank Bldg., 150,000 gal. steel tower and tank, concrete tank and tower founds., pumping equipment, 500 g.p.m. direct connected centrifugal pump or 500 g.p.m. electric deep well turbine pumping unit, both with automatic control, 1,700 ft. 6- to 10-in. c.i. pipe. $50,000. O. R. Mann, clk.

Mass., Holyoke—City. Bd. Water Comrs., taking bids standpipe.

Mass., Worthington—Oct. 25, by Water Comrs. 9,000 lin.ft. 4 in. main from Worthington Center to Reservoir on Witts Hill.

Mich., Detroit—See "Contracts Awarded."

Minn., Detroit Lakes — Oct. 26, by E. J. Bestick, clk., furnishing, installing 3 horizontal centrifugal pumps. Wolff & Coates, 903 Globe Bldg., St. Paul, engrs.

Mo., Maysville—Oct. 27, by A. D. Hewitt, city clk., 26,000 lin.ft. 2- to 6-in. c.i. pipe with special fittings, 32 fire hydrants, 9 gate valves, boxes, coagulating basin, clear well, filters and building for pumping plant, 4 motor driven pumps, impounding reservoir, incl. earth dam with concrete intake structure and spillway, two 150,000 g.p.d. filter units, 100 water meters; 1,000 ft. fire hose, nozzles and automobile fire truck pumper. W. B. Rollins & Co., 339 Railway Exch. Bldg., Kansas City, engrs. Noted Oct. 8.

N. Y., Brooklyn—Oct. 30, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Wellington Court, Kings Highway, Avenues K, N and W, Schenectady, Troy and 12th Aves., Havemayer, St. Felix, East 16th, East 17th, East 18th, East 43rd Sts.

N. Y., Brooklyn—Oct. 27, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Avenue S, Batchelder St., Fillmore, Flatbush, and Gerritsen Aves.

N. Y., Colonie—Oct. 23, by Comrs. Latham Water Dist., at Pitts Hose Co., Latham, 33,000 ft. 6- to 12-in. c.i. mains equipped with valves, hydrants; 39,650 ft. 6- to 10-in. c.i. mains equipped with valves, hydrants. Solomon & Keis, 257 Bway., Troy, consult. engrs.

N. Y., Kings Park—Oct. 28, at office Dpt. Mental Hygiene, F. W. Parsons, comr., State Office Bldg., Albany, 2 driven wells at Kings Park State Hospital, Kings Park, Suffolk Co.

Wash., Seattle—Water Dist. 20 bids about Dec. 5, diverting 15 sec. ft. water from Rock Creek for waterworks. Miller Eng. Co., Burke Bldg., engr.

Wash., Seattle—Bd. P. Wks., bids about Oct. 26, replacing sections Beacon Hill-Cedar River pipe line with 1.5 mi. 66 in. steel, c.i. or concrete pipe. $260,000. W. D. Morris, city engr.

Ont., Ottawa—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—Los Angeles Co., circular steel water storage tank, 38 ft. diam., 50 ft. tower, at County General Hospital, to Chicago Bridge & Iron Wks., Pacific Mutual Bldg., $9,515. Noted Sept. 17.

Calif., Pasadena—See "Proposed Work."

Conn., Rocky Hill—Rocky Hill Inc. Dist. of Rocky Hill, water distribution system, to D. DiPietro, Bellingham, Mass. Est. $15,000 or more. Noted Sept. 17.

Ind., Ambia—Installing 11,000 lin.ft. mains, to A. Warner, Hoopeston, Ill. Est. $15,000.

Ind., Fairmount—City Council, 6 in. mains in 7 blocks streets, to C. R. Morris, Selma, Est. $15,000. Noted Oct. 22.

Ind., Indianapolis—A. R. Smith, city clk., 400,000 gal. steel tank on tower, to Pittsburgh-Des Moines Steel Co., Tuttle and Southwest 10th Sts., Des Moines. $17,100. Est. $25,000. Noted Sept. 24.

Ind., Petersburg—Petersburg Water Co., general contract brick, steel pumping and filtration plants, to Brown & Mick, 1020 East Michigan St., Indianapolis, Est. $80,000. Pumping equipment desired. Noted Sept. 17.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., laying, relaying water pipes in West Roxbury, to M. DeSisto Co., 198 Lagrange St., West Roxbury. Est. $15,000. Noted Sept. 17.

Mass., Holyoke—City, 2 centrifugal pumps for Homestead Ave. Pumphouse, to Worthington Pump & Mchry. Corp., 37 Appleton St.

Mich., Detroit—Dpt. Water Supply, 735 Randolph St., backfilling around power and filtration structures at Springwells Station, incl. 80,000 cu.yd. backfilling, 30,000 cu.yd. borrow pits, 50,000 cu.yd. foundry sand and materials from spoil piles on site, own forces. $50,000. Former bids rejected. G. H. Fenkell, genl. mgr. Noted Sept. 10.

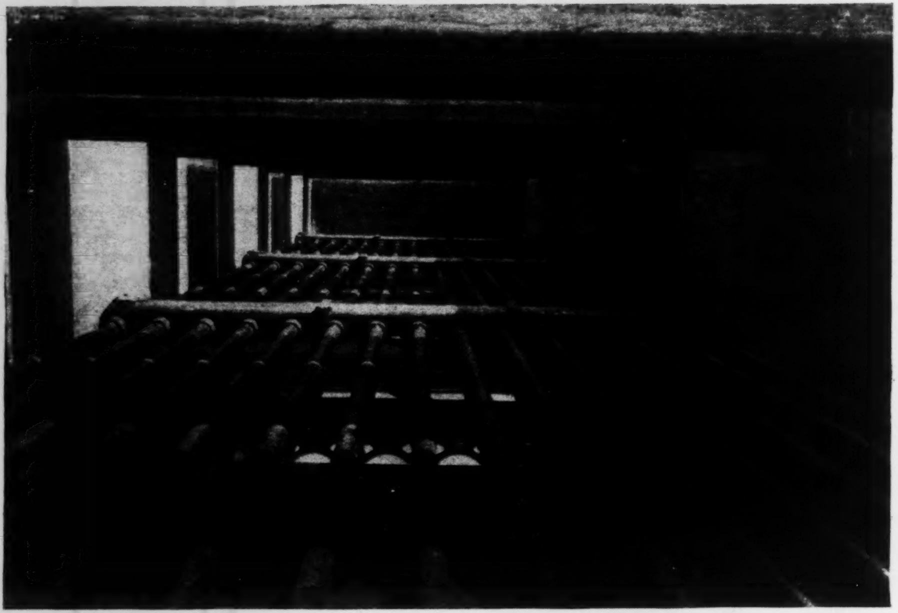
Mich., Detroit—Dept. Water Supply, training walls and booms for intake lagoon, incl. 300 cu.yd. dredging, 2,000 lb. reinforcing steel, 1,050 cu.yd. concrete, 280 tons steel sheet piling, 7 tons miscellaneous steel, to Culbertson & Kelly, 872 West Milwaukee Ave., $30,495.

Mich., Detroit — Bd. Water Comrs., 735 Randolph St., auxiliary piping system, incl.

See proposal advertising on page 96

LEADITE

Trade Mark Registered U.S. Pat. Office



Filtration Plant Underdrain . . . .

—*another important job jointed with LEADITE*

In Filter Plants, Tight, Durable and Permanent Pipe Joints are essential. For this reason LEADITE is used in numerous Filter Plants for jointing the c. i. bell and spigot lines.

LEADITE not only makes a Good, Tight, Reliable Joint,—but experience has proven that it offers a CONSIDERABLE SAVING over the caulking method of making joints.

●

Thousands of miles of bell and spigot pipe are jointed with LEADITE,—and it is the most Widely Used, Most Frequently Discussed, and the Oldest Established Self-caulking Jointing Material for Bell and Spigot Pipe.

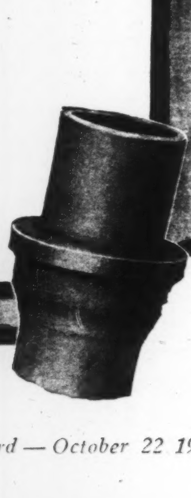
"SPECIFY LEADITE FOR SERVICE AND SAVING"

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%

THE LEADITE COMPANY
Land Title Building - - Philadelphia, Pa.

100 LBS.
LEADITE
REG. U.S. PAT. OFF.
CEMENT
for JOINTING WATER MAINS
MANUFACTURED BY
THE LEADITE COMPANY
PHILADELPHIA, PA.

No Caulking



Waterworks (Continued)

piping for control hydraulically operated gate valves, automatic water-operated check valves, water piping for pumping and power plants, for Springwells Station, to Lorne Plumbing & Heating Co., 641 West Congress St., $25,790. Noted Sept. 17.

N. J., Paterson—Passaic Valley Water Comn., 156 Ellison St., steel plate and c.i. suction and discharge piping at Little Falls Pumping Station, to Fuller Constr. Co., Red Bank, $82,200.

N. J., Woodcliff Lake—Mayor and Bd. Boro Council, mains, appurtenances through various streets, to J. P. Burns, Dumont. Est. $15,000. Noted Sept. 3.

N. Y., New York—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Anderson Ave., to Bronx Water Works, 1 Riverdale Ave., $18,475. Noted Oct. 1.

Okla., Haskell—City, main extensions, new supply line, to E. W. Baker & Co., 227 Southwest 21st St., Oklahoma City, $27,845. Est. $35,000. Noted Sept. 3.

Tenn., Nashville—Bd. P. Wks., at office S. H. McKay, city clk., 14 m.g. filtration plant, to W. L. Hailey & Co., 314 42nd Ave. N., $119,-323. Noted Sept. 24.

Utah, Salt Lake City—City Comrs., 27th South, to H. E. Schraven, Boston Bldg., $52,226.

Wis., Hayward—Brick, steel iron removal filtration plant, equipment, to H. A. Nelson, Hayward, $22,205. Est. $25,000.

Ont., Ottawa—City, 20 in. main on Nicholas St. from Lourier Ave. to Somerset St. and two 15 in. mains under Rideau Canal and railway yards opposite to Somorset St., day labor. $34,000. F. C. Askwith, City Hall, engr.

SEWERS

PROPOSED WORK

Calif., El Centro—New outfall sewer, incl. installing pumping plant. 7,500 ft. c.i. pump line, 2,900 ft. vitr. clay pipe, acid proof joints material. $177,000. P. Knight, city engr., Burns-McDonnell-Smith Eng. Corp., Western-Pacific Bldg., Los Angeles, consult. engrs.

Calif., Los Angeles—City Council West Channel Road Sewer Unit. $19,500. J. J. Jessup, city engr.

Calif., Los Angeles—Bd. P. Wks., pumping plant, Wilmington Intercepting Sewer Unit 3. $40,000. J. J. Jessup, city engr.

Calif., Los Angeles—Bd. P. Wks., City Hall, Venice Outfall Sewer Pumping Plant. $31,560. J. J. Jessup, city engr.

Colo., Denver—Soon takes bids Park Hill Sewer. $4,000,000. W. B. Lowry, mgr. Parks and Improvements.

Ill., Belvedere—City Council, cleaning up Kishwaukee River, and treating sewage as discharged into same. G. W. Hicks, supt. Water Dpt.

Ill., Waukegan—City Council plans intercepting sewer connecting with North Shore Sanitary Dist. treatment plant, incl. 1,700 ft. 24 in. and 7,900 ft. 54 in. pipe. H. Bleak, city engr.

Ind., Warsaw—City Council, repairing sewers. $25,000. F. M. Smith, Warsaw, engr.

Ia., Cedar Rapids—City Council, L. J. Storey, clk., 3,270 ft. 54, 60 an d72 in. storm sewers. $60,000. F. E. Young, city engr.

Ia., Nevada—City, c/o R. A. Davis, clk., sewage disposal plant. $50,000. H. V. Pedersen, 11 North 11th St., Marshalltown, engr.

Mich., Jackson—City postponed taking bids sewage plant and system, primary and final settling tanks, aeration links, pipe gallery, distributor with screen and incinerator, digesters, operating building, sludge beds, piping, main building. $604,900. W. R. Cruse, City Hall, engr. Noted Sept. 24.

Minn., Brainard—City, E. T. Fleener, clk., storm sewers incl. 15,400 lin.ft. main pipe line and smaller branches in Main St. between Mississippi River, 10th St., and intersecting streets. $42,000. R. T. Campbell, city engr.

Okla., Durant—Preliminary plans new sewage disposal plant. $60,000. L. V. Stinson, Durant, engr.

R. I., Bristol—Town, W. T. Dwyer, secy., Sewer Comn., bids in December, sewage disposal plant. $225,000. F. Spofford & Thorndike, 44 School St., Boston, and H. K. Barrows, 6 Beacon St., Boston, engrs.

Tex., Dallas—Bd. P. Wks., O. H. Coch, dir., sewer extensions. $500,000.

Tex., San Antonio—Preliminary plans sewage treatment plant, incl. sludge drier, grinder, conveyor, filtration bed sweeper. $65,000. Wants quotations on conveyors. I. Ewig, city engr.

Utah, Salt Lake City—For 6- to 10-in. sewers in 2nd West and 7th South Sts., Paramount, Claybourne and Melbourne Aves. $15,000. H. Jessen, city engr.

Wis., Alma — City, O. Hitt, clk., sewerage system. $35,000. F. J. Davy, 608 West Ave., LaCrosse, engr.

Wis., Appleton—Fox River Valley Metropolitan Sewer Dist. retained Pearce, Greeley & Hanson, engrs., 6 North Michigan Ave., Chicago, Ill., to draw plans sewerage system.

Wis., Cedar Grove—Sewerage system. $25,000. McMahon Eng. Co., Menasha, engr.

Wis., Grafton—City, R. P. Zahn, clk., sewage disposal and treatment plant, incl. equipment. $25,000. P. L. Clark, 207 West College Ave., Appleton, engr.

Wis., Menominee Falls—City, H. Meyer, clk., sewerage system, sewage treatment plant. $25,000. P. L. Clark, 207 College Ave., Appleton, engr.

Wis., Wautoma—Sewerage system, treatment plant. $25,000-$30,000. P. L. Clark, 207 College Ave., Appleton, engr.

Ont., Georgetown—Town, 8 in. and up vitr. tile sanitary sewers, manholes, house connections. $30,000. R. F. Smith, Oakville, engr.

Ont., Hanover—Town 8 in. and up, storm and sanitary sewer extensions, incl. manholes. $50,000. C. R. Hagey, Fort Erie, engr.

Ont., Overbrook — C. H. Guest, twp. clk., Billings Bridge, soon takes bids new sewerage system. $30,000. W. L. Cassels, Banque Natl. Bldg., Ottawa, engr.

Ont., Pembroke—Town 18 in. in diam. and up, concrete trunk sewer in Lake and Water Sts. $35,000. J. P. Howe, Town Hall, engr.

Ont., Toronto—For 1 mi. concrete, brick, trunk storm sewer from Park Dr. to Don River. $288,820. R. C. Harris, City Hall, engr.

Ont., Toronto — East York Twp. rein.-con. activated sludge sewage disposal plant additions. $50,000. R. G. Jack, 443 Sammon Ave., engr.

Que., Westmount—City Council trunk sewer linking Westmount conduits with Montreal sewerage system. $300,000. Federal and Provincial Governments to contribute toward cost.

BIDS ASKED

California—Oct. 28, by C. H. Purcell, engr. State Hy. Comn., Sacramento, grading, concrete paving 9.7 mi. road between Los Alamos and 2 mi. north of Solomon Summit, Santa Barbara Co.; 0.6 mi. road between Del Mar and Solano Beach, San Diego Co.

Calif., Long Beach—Nov. 6, by City Council, North Long Beach Sewer Dist. (Pump Sewer Dist. 11), incl. 250,000 ft. 8 in. and 17,590 ft. 12 in. vitr. clay sewers, 95,600 ft. 6 in. vitr. connection sewers, 600 g.p.m. pumping station, incl. two 6 and one 8 in. pumps. Former bid call cancelled. Noted Oct. 1.

Ky., Louisvile—Nov. 6, by Commissioners of Sewerage, 400 Marion E. Taylor Bldg., 2,690 ft. 24 to 48 in. trunk line sewer, manholes, appurtenances in Montana Ave. from Larchmont to Winkler Sts., Sect. C. S. Montana Trunk Sewer, W. M. Caye, Marion E. Taylor Bldg., engr.

Mass., Boston—Oct. 29, by Metropolitan Dist. Comn., 20 Somerset St., Constructing Sect. 125 Braintree-Weymouth Sewer. to exceed $25,000.

Mich., Owosso—Oct. 26, by G. A. Van Epps, city clk., City Hall, 8,000 ft. 30 in. concrete, sewers, manholes, connections. Address City Engineer.

Mich., Owosso — Oct. 26, by City Council, 15,000 ft. 6- to 30-in. vitr. clay intercepting sewers, 19,500 cu.yd. trenching, 2,000 cu.yd. excav. $90,000 voted for same. N. I. Raymond, city engr.

New York—Oct. 30, by Supervs. Westchester Co. Sanitary Sewer Comm., Court House, White Plains, Sect. Z, Mamaroneck Project, in New Rochelle and Mamaroneck, incl. 3,300 ft. 14- to 27-in. trunk sewer, incl. tunnel, c.i. and precast rein.-con. concrete pipe. W. W. Young, Court House Annex, White Plains, consult. engr; adv. E.N.-R. Oct. 22.

N. Y., Beacon—Oct. 27, at office Dpt. Correction, State Office Bldg., Albany, sewage disposal system, outfall sewer at Matteawan State Hospital, W. N. Thayer, Jr., comr.

N. Y., Brooklyn—Oct. 28, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, storm water and sanitary sewers in Bedford Ave. and Maple St.

N. Y., North Yonkers—Nov. 6, by Westchester Co. Sanitary Sewer Comn., Court House, White Plains, sterilization plant, Saunders Dock. To exceed $500,000. Noted Sept. 24.

Pa., Phila.—Oct. 28, by Dpt. P. Wks., Brueau Eng. & Surveys, City Hall Annex, A. Murdock, dir., Schedule A. branch sewers; Schedule B. main relief sewer in Fairmont Park and Fairmont Ave. between present terminus near Pennsylvania Ave. and 23rd St.

S. D., Rapid City—Nov. 12, by Bd. City Comr., C. I. Leedy, aud., City Hall, sewage treatment works, incl. wet and dry excava. concrete tanks, crushed stone trickling filter beds, sludge beds, sludge pump station, certain pipe, etc. A. A. Chenoweth, Alex. Johnson Hotel, engr.

S. D., Sioux Falls—Oct. 26, by City, 8,875 lin.ft. sanitary sewers, 25 manholes. W. C. Layse, city aud.

Wis., Milwaukee—Oct. 30, by Metropolitan Sewerage Comn., sewer in River Rd., Belle Island Dr. and Lincoln Park, incl. 6,664 ft. special concrete; 501 ft. 20 in. c.f. and 3,306 ft. 24 and 30 in. tile pipe. J. L. Ferebee, ch. engr.

Wis., Superior — Oct. 28, by E. B. Banks, engr., City Hall, 6,000 ft. sewer in 26th St. and Weeks Ave. from 32nd St. and Oakes Ave., for City. $130,000.

Ont., London—See "Contracts Awarded."

CONTRACTS AWARDED

Ill., Bushnell—East Side Sewage Disposal Plant, to R. McCalman, Inc., Danville, $23,700.

Md., Baltimore—Mayor and City Council, storm drains, sanitary sewers as listed in Sanitary Contr. 269, to Aiello Constr. Co., Gough and Dean Sts., $59,190.

Mass., Boston—Dpt. P. Wks., sewerage works, West Roxbury, to A. Cefalo, 19 Cefalo Rd., West Roxbury, $19,722. est. $25,000.

Mass., Woburn—For 2,700 ft. sewer in Salem and Cedar Sts., to J. Butera Constr. Co., 144 Cooper St., Woonsocket, R. I. Est. $25,000.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewer in 75th St., to Catam Co., Inc., $21,822. Noted Sept. 10.

Pa., Phila.—Dpt. P. Wks., Bureau Eng. & Surveys, City Hall Annex, A. Murdock, dir., branch sewers in Church Lane from 20th St. to Ogontz Ave. and main sewer in Castor Ave. from Frankford Ave. to Glenwood Ave. and in Glenwood Ave. from Castor Ave. to L St., to E. Ventresca, 6016 Röss St., $525 and $58,-166 respectively; branch sewers in Cumberland St. from Front St. to Kensington Ave. and main sewer in Tyson Ave. from Shelborne St. to Hasbrook St. and in Hasbrook St. from Tyson Ave. to sewerage system in Cheltenham Twp., to V. Neamaud, 628 Levick St., $6,140 and $13,478 respectively; branch sewers in 4th St. from Clarkson Ave. to Tabor Rd., to G. A. Delise & A. De Angelo, 4842 North Leithgow St., $709; Green St. from 3rd to 4th Sts., to De Sipo & Vallone, 28th and Wolf Sts., $5,838; McKean St. from 26th to 28th Sts. and 56th St. from Lindbergh Blvd. to Eastwick Ave., to P. and J. Ellis, 4th and Cortland Sts., $5,807 and $3,790 respectively; Olney Ave. from 6th to 7th Sts. to J. J. McHugh, 1617 Race St., $4,362; 70th St. from Paschall Ave. to Linmore St., to Campellone & Diorie, 3856 North 10th St., $1,558; Woodcrest Ave. from 59th St. to Upland Ave., to A. DiSandro & Son, 6400 North 5th St., $6,930; replacing old sewer with new in Hunting Park Ave. at East River Dr., to R. DeVito, 6314 Dicks St., $11,761. Grand total $119,064.

Pa., Phila.—Dpt. P. Wks., Bureau Eng. & Surveys, City Hall Annex, A. Murdock, dir., branch sewers in Chelwynde St. from 62nd to 64th Sts., to D. Sabatini & Son, 2008 McKean St., $5,488; 57th St. from Baltimore St. to summit south adn Hartel St. from Castor to Large Sts., to Leva Bros., 104 West Gale St., $4,056 and $6,335 respectively; Hutchinson St. from Nedro to Champlost Sts., Nedro St. from Hutchinson to 11th Sts. and 10th St. from Nedro to summit north, to A. Di Sandro & Son, 6400 North 5th St., $13,125; Memphis St. from Tioga to Venango Sts., to De Sipio & Vallone, 28th and Wolf Sts., $7,282; Palethorp St. from Annsbury to Winghocking Sts., to Leverington Constr. Co., 332 Leverington Ave., $1,795; 3rd St. from Catherine to Christian Sts., to Gallaccio, Acchone & Angelo Constr. Co., 2328 South Chadwick St., $4,431; Washington Lane from Rugby to Thouron Sts., to V. Jafolla, Oxford Bank Bldg., $2,855. Grand total $45,367.

Pa., Pittsburgh—See "Streets and Roads

Pa., Richeyville—Jones & Laughlin Steel Co., sewage disposal plant, pump house, 1 story, 10x12 ft., brick pump house, 18x24 ft. settling tank, 55x100 ft. filter bed, between Bellville and Centerville St., to Harris Constr. Co., California, Pa.

Ont., London—City Council, St. Julien Trunk Sewer, day labor, under supervision A. Near, city engr. $400,000.

WASTE DISPOSAL

PROPOSED WORK

Ind., Hammond — City Council, incinerator plant. $78,000.

CONTRACTS AWARDED

Mass Worcester—City, incinerator, to Decarie Incinerator Co., 312 Madison Ave., New York. Noted Sept. 10.

BRIDGES

PROPOSED WORK

Calif., Sacramento—City Council, Sacramento Co., and State Hy. Comn., and Sacramento and San Francisco R.R. companies, bridge over Sacramento River at M St. C. Deterding, Jr., co. engr.

N. Y., West Islip—Long Island State Park Comn., Babylon, 2,000 ft. suspension bridge over Great South Bay off Conklins Point, as part of proposed Cap Tree Island causeway. A. E. Howland, Babylon, ch. engr.

O., Zanesville—Concrete bridge over Licking River, at State St. $80,000.

BIDS ASKED

California—Nov. 4, by C. H. Purcell, engr. State Hy. Comn., Sacramento, reconstructing existing bridge consisting twenty-two 24 ft. timber trestle approach spans on pile bents, three 250 ft. steel truss spans by removing timber trestle approach spans and constructing twenty-three 19 ft. timber trestle approach spans on timber pile bents, also removing timber stringers and floor of steel truss spans and placing new timber stringers and laminated floor, over Eel River at Robinsons Ferry, 19 mi. north of Dyerville, Humboldt Co.

Constr. News page 119

Bridges (Continued)

California—Oct. 28, by C. H. Purcell, engr. State Hy. Comn., Sacramento, three 50 ft. span steel beam bridge on concrete bents, abutments with wing walls over Beaver Creek, 15.5 mi. west of Junction Route 3, Siskiyou Co.—one 34 ft. and two 23 ft. span rein.-con. girder bridge on concrete piers, abutments over San Juan Creek, and three 100 ft. span steel deck truss bridge with concrete deck on concrete piers with pile founds., ten 40 ft. rein.-con. girder spans on concrete pile bents over San Benito River, both 8 mi. south of Gilroy, San Benito Co.—one 60 ft., two 30 ft. span rein.-con. girder bridge on concrete piers, concrete pile founds., concrete pile bents over Arroyo Calleguas, Ventura Co.

Del., Wilmington—Nov. 3, by Bd. Supervs. New Castle Co., bridge over Brandywine River, at 11th St. To exceed $350,000. Ash, Howard, Needles & Tamen, 55 Liberty St., New York, engrs.

Indiana—Nov. 5, by State Hy. Comn., Indianapolis, 36 ft. rein-con. girder bridge, 24 ft. roadway over Haines Creek near Pennville, Jay Co.—four 41 ft. rein.-con. girder and one 66 ft. steel girder span bridge, 44 ft. roadway over Baltimore & Ohio R. R., east of Gary, also concrete, bituminous concrete or brick surfacing 0.35 mi., grading 88,000 cu.yd. approaches, Porter Co.—20 ft. rein.-con. slab bridge, 24 ft. roadway over Taylor Creek, near Marion, Grant Co.—40 ft. rein.-con. girder bridge, 24 ft. roadway over Dry Owl Creek, near Lafayette—40 ft. rein.-con. arch bridge, 32 ft. roadway over Buck Creek—three 50 ft. span rein.-con. girder bridge, 24 ft. roadway over Sugar Creek, 32 ft. rein.-con. girder bridge, 24 ft. roadway over Bridge Creek, all foregoing near Americus, Tippecanoe Co.—two 70 ft. spans rein.-con. arch bridge 24 ft. roadway over Deer Creek near Delphi, Carroll Co.—35 ft. rein.-con. arch bridge, 24 ft. roadway over branch of Silver Creek, near New Albany, also grading 2,400 cu.yd. approaches, Floyd Co.—32 ft. rein.-con. girder bridge, 24 ft. roadway over Monocah Creek—28 ft. extension to rein.-con. girder bridge over Clear Creek, both near New Winchester, Putnam Co.—28 ft. rein.-con. girder bridge, 24 ft. roadway over fork of Mill Creek, near New Winchester, Hendricks Co.—40 ft. rein.-con. arch bridge, 32 ft. roadway over Cripes Creek, near Rossville, incl. grading 3,400 cu.yd. approaches, Clinton Co.—75 ft. rein.-con. arch bridge, 24 ft. roadway over Duck Creek—three 198 ft. span steel truss bridge, 22 ft. roadway over White Water River, both near Metamora, Franklin Co. $500,000. J. J. Brown, dir.

Maryland—Oct. 27, by State Roads Comn., Baltimore, structural steel superstructure (double 102 ft. span steel truss) for bridge over Town Creek on road from Old Town to Paw Paw, Contr. A-109-64 Allegany Co.—double span concrete slab bridge over Bucklodge Branch, on Bucklodge-Dawsonville Rd., Contr. M-191-57, Montgomery Co. H. Williar, Jr., Federal Reserve Bank Bldg., Baltimore, engr.

Massachusetts — Oct. 27, by Dpt. P. Wks., State House, Boston, A. W. Dean, engr., 3 span, 782 ft. deck arch bridge over Connecticut River between Erving and Gill, for Commonwealth of Massachusetts.

Michigan—Oct. 28, by H. W. Hagaman, div. engr., Cadillac, MBr. 2 or 76-15.14, Contrs. 2 and 3, one 87½ ft. span, 2 rein.-con. semi-gravity type abutments, steel deck girder with fabricated beams, rein.-con. flooring, surface and spindle railing, two 2½ ft. sidewalks, Shiwassee Co.; F MBr. 1 of 77-12-9 contr. 1 and 2, three 55 ft. spans, 2 rein.-con., semi-gravity type abutments, steel deck girder, rolled beams, with rein.-con. flooring, concrete wearing surface and railing, two 6 ft. sidewalks, St. Clair Co., for State Hy. Comn., Lansing.

Michigan—Oct. 29, by A. L. Burridge, div. engr., Cadillac, MBr. 1 of 5-7-2 Contr. 1 and 2, one 60 ft. span, 2 rein.-con., semi-gravity type abutments, steel deck girder (rolled beams), with concrete flooring, surface and railing, two 6 ft. sidewalks, Antrim Co., for State Hy. Com., Lansing.

Michigan—Oct. 30, by W. J. Kingscott, div. engr., 213 Watson Bldg., Grand Rapids, F. Aid Br. 1 of 61-13-9, Contrs. 1 and 2, three 20 ft. spans, rein.-con. semi-gravity type abutments, steel deck girder with rolled beams, concrete flooring, wearing surface and railing, two 3 ft. sidewalks, Muskegon Co., for State Hy. Comn., Lansing.

Minn., Brainerd—Nov. 10, by State Hy. Dpt., St. Paul, bridge 5060, 610 ft., concrete arch over Mississippi River on S. P. 2-30-4, $200,000.

Washington—Nov. 3, by S. J. Humes, dir. Hys., Olympia, 640 ft. steel bridge over Wenatchee River, on State Rd. 2, F.A.P. 149-B, Chelan Co.—404 ft. steel, concrete bridge over Skokomish River, F.A.P. 136-E, State Rd. 9, Mason Co.—grading, draining 2.7 mi. State Rd. 5, Yakima-Nelson's Bridge, F.A.P. 161-C, Yakima Co.—stockpiling 13,300 cu.yd. crushed stone surfacing material Shushuskin Canyon-Wenas Rd. between Ellensberg and Yakima, Kittitas and Yakima Counties.

CONTRACTS AWARDED

Calif., San Francisco—S. J. Hester, secy., Bd. P. Wks., City Hall, Strauss Steel Trunnion Bascule Bridge, incl. substructure, superstructure, approaches, over channel at 3rd St., to Barrett & Hilp, 918 Harrison St., $552,590. Noted Sept. 24.

Calif., San Francisco—S. J. Hester, secy. Bd. P. Wks., City Hall Lincoln Way Viaduct in connection with Sunset Blvd. Project, incl. 22,000 cu.yd. excav., 45 cu.yd. Class A, 2,550 cu.yd. Class B and 185 cu.yd. Class F concrete, 472,000 lb. bar reinforcing steel, 8,000 lb. bronze bearing plate in place, electric work, incl. electroliers, 1½ in. asphaltic concrete and 1½ in. binder surfacing 16,500 sq.ft., to F. C. Amoroso & Sons, Wallace and Keith Sts., $72,937. Noted Sept. 3.

Ind., Evansville—Bd. Comrs. Vanderburgh Co., Franklin St. Bridge, steel cantilever type, incased in concrete over Pigeon Creek, to Globe Constr. Co., 2307 West Franklin St. **$129,890.** Noted Sept. 22.

Iowa—State Hy. Comm., Ames, three 40x24 ft. span I-beam bridge, 11 culverts, Buchanan Co., to Wagh & Tackerman, Clarksville, $10,795—80x20 ft. pony truss bridge with two 40x20 approach spans, Lee Co., to A. Olson Constr. Co., Waterloo, $13,085—90x24 ft. plate girder bridge with two 24x40 ft. I-beam approach spans, Marion Co., to F. E. Stoops, Ames, $14,495—three 32x23 ft. span I-beam bridge, two 150x20 ft. high trusses with two 40x20 ft. I-beam approach spans, one 32x24 ft. I-beam, three 40x24 ft. span I-beam and one 60x24 ft. I-beam bridges, Montgonery Co., steel sheeting, riprap on 120x20 ft. high truss bridge Pottawattamie Co., to Wickham Bridge & Pipe Co., Council Bluffs, $53,900 and $1,643 respectively— steel sheeting and riprap on 120x20 ft. high truss bridge Pottawattamie Co. and 20x16 ft. box culvert, Woodbury Co., to Christensen Bros., Tyler, Minn., $990 and $6,185 respectively—$1,643. Grand total $101,093. Noted Oct. 1.

Maine—State Hy. Dpt., Augusta, bridge Thomaston, to Reed & Reed, Woolwich, $20,752—bridge over Androscoggin River Auburn, to Kennebec Constr. Co., Waterville, $46,725—bridge over Piscataquis River, Shirley, to E. L. Keene, Madison, $4,564—bridge over Fall Brook, Solon, to Tidewater Constr. Co., Yarmouth, $7,949—bridge over Robinhood Cove, Georgetown, to F. W. Carlton, Woolwich, $14,656. Grand total $94,646. Noted Sept. 14 Daily.

Maryland—State Roads Comn., C. H. Uhl, chn., Baltimore, double-leaf bascule span superstructure complete, for proposed bridge over Bohemia River on Chesapeake City-Ceilton Rd., Contr. CE-118-27, Cecil Co., and double-leaf bascule span superstructure complete for proposed bridge over Marshyhope Creek on Rhodesdale-Eldorado Rd. at Brookview, Contr. CE-84-17, Dorchester Co., to A. S. Fox & Co., 655 Ridgedale St., Dayton, O., $33,844 and $35,138 respectively. Noted Sept. 24.

Md., Baltimore—Pennsylvania R. R. Co., Broad St. Sta. Bldg., 1617 Pennsylvania Blvd., Phila., Pa., T. J. Skillman, ch. engr., bridges to carry tracks over Gay, Preston, Wolfe, Washington and Biddle Sts., also relocating Ellsworth St., to Arundel Corp., Mt. Vernon Yards, Baltimore, Est. $150,000.

Mass., Chicopee—City, et al., F. P. Cobb, engr., steel, rein.-con. bridge over Boston & Albany R.R., McKinistry Ave., to Daniel O'Connell Sons Inc., 480 Hampden St., Holyoke. Est. $30,000 or more.

N. H., Pittsburg—State Hy. Dpt., Concord, 107 ft. twin span plate girder bridge over Connecticut River, to Eastern State Bridge Co., York, Pa. Est. $37,057. Noted Sept. 24, under "New Hampshire."

New York—A. Goldman, comr. Plant & Structures, Municipal Bldg., New York, masonry piers for towers of Triborough Bridge, connecting Manhattan, Bronx and Queens Boros, to Rodgers & Haggerty, Grand Central Terminal, New York, $341,858. Noted Oct. 1.

Pa., Phila.—Dpt. P. Wks., Bureau Eng. & Surveys, City Hall Annex, bridge at Summerdale Ave. under Philadelphia and Frankford Branch of Reading R.R., to G. F. Dobbin, 1020 South 47th St., $49,207—bridge at University Ave. under Pennsylvania R.R. and Philadelphia, Baltimore and Washington R.R., to P. and J. Ellis, 4th and Courtland Sts., $229,601—clearing site for bridge at Henry Ave. between School House Lane and Wissahickon Creek, to M. Masse, 3936 North Reese St., $2,574. Grand total $281,382.

Pa., Pittsburgh—See "Streets and Roads."

Rhode Island—State Bd. P. Roads, State Office Bldg., Providence, Wawaloam Bridge, Charlestown-Richmond, to Luten Bridge Co., Inc., Loew Bldg., Syracuse, N. Y., $26,118. Noted Oct. 5 Daily.

STREETS AND ROADS

BIDS ASKED

Ark., Mountain Home—See "Contracts Awarded."

California—Nov. 4, by C. H. Purcell, engr. State Hy. Comn., Sacramento, grading, oil treated selected material surfacing 10.9 mi. road between Devore and Alray, San Bernardino Co.

Calif., Long Beach—Oct. 30, by City Council, curbing, guttering, 95,000 sq.ft. sidewalks, 10,316 ft. 2- to 12-in c.i. mains in Hewitt

Calif., Ventura—Nov. 3, by L. E. Hallowell, clk. Ventura Co., improving Ventura Ave., incl. 12,650 cu.yd. earth exca., 470 cu.yd. A concrete, 4,500 lb. reinforcing steel, 600 lb. steel dowels, 335 cu.yd. sand cushion.

Delaware—Nov. 10, by State Hy. D Dover, clearing, grubbing, grading con paving 2.6 mi. Farnhurst-Wilmington Rd., Contr. 209, New Castle Co.—5.57 mi. Contr. 176, Castle Co.—3.83 mi. Frankford-Roxana Rd., Contr. 194,—4.1 mi. Georgetown-Springfield X Rds., Contr. 177, all foregoing in Sussex Co.—grading, terra cotta sewer, catch basin, drop inlet castings, concrete, sidewalks, 6,500 ft. Holly Oak-Claymont Rd., Philadelphia Pike, Contr. 210, New Castle Co.—2,720 ft. Camden-Camp Meeting Woods, Contr. 211, 4,300 ft. Clayton-Smyrna Rd., Contr. 212, both Kent Co.—1,025 ft. Blades-Seaford Town Line, Contr. 213, Sussex Co.—1,600 ft. Millsboro Rd. towards Harmon School, Contr. 214—Barkers Landing Causeway, Contr. 215, New Castle Co.

Kentucky — Oct. 28, by State Hy. Dpt., Frankfort **(S.A.P. means State Aid Project)**, grading, drainage structures 5.124 mi. Cave City-Hiseville Rd., S.A.P. 11-AG, 30 and 36 ft., Barren Co.—1.205 mi. Ashland-Greenup Rd., S.A.P. 20-DG, 30 and 42 ft., Boyd Co.—5.41 mi. Morgantown-Caneyville Rd., S.A.P. 83-AG 24 and 30 ft. Butler Co.—15.151 mi. Hopkinsville-Princeton Rd., S.A.P. 10-AG, 24 and 30 ft., Christian Co.—surfacing 4.63 mi. Murray-New Concord Rd., S.A.P. 119-AS, 18 ft., Calloway Co. B. Johnson, chn.

Maryland—Oct. 27, by State Roads Comn., Baltimore, concrete shoulders 0.6 mi. hy. along Bond St. and Belair Rd., Belair, Contr. H-134-411 Harford Co.—concrete paving 1 mi. and macadam paving 0.96 mi. hy. along Dickerson Mt. Ephreaim Rd. and along Dickerson-Martinsburg Rd., Contr. M-181-55—concrete girder bridge, concrete paving 0.73 mi. hy. along Mass. Ave. from District of Columbia line to Little Falls Branch. Contr. M-189-35—curbing, guttering 0.53 mi. hy. along Frederick Ave. from Corporate limits of Gaithersburg to Brooks Ave., Contr. 192-55, all foregoing in Montgomery Co.—concrete base and header, 0.3 mi. hy in University of Maryland Grounds, at College Park. Contr. P-198-311 Prince George's Co.—macadam paving 1 mi hy. along Timber Ridge Rd. from National Pike East of Hancock towards Pennsylvania state line, Contr. W-99-64 Washington Co. H. Williar, Jr., Federal Reserve Bank Bldg., Baltimore, engr.

Massachusetts—Oct. 27, by Dpt. P. Wks., A. W. Dean, engr., State House, Boston, rein.-con. paving 28,822 ft. hy., incl. rein.-con. bridge over Neponset River, Sharon, Walpole and Norwood—rein.-con. paving 15,921 ft. hy., incl. 2 span steel stringer and 2 plate girder bridges Worcester and Shrewsbury.

Massachusetts—Oct. 27, by Dpt. P. Wks. A. W. Dean, State House, Boston, engr., bituminous macadam paving 9,446 ft. hy. Williamstown; broken stone and asphalt paving 8,262 ft. hy. Newburyport and Newbury.

Mass., Boston—Oct. 26, by Dpt. P. Wks. J. A. Rourke, comr., granite block paving Dover St., Boston Proper. $25,000.

Mass., Boston—Oct. 27, by Dpt. P. Wks. J. A. Rourke, comr., sheet asphalt or bitulithic paving Fawndale Rd. and Faneuil St. $25,000.

Mass., Boston—Oct. 27. by Dpt. P. Wks., A. W. Dean, engr., bituminous macadam paving 11,142 ft. hy., incl. steel ribbed 3 hinged arch type bridge, Dorchester Sect.

Michigan—Oct. 27, by H. W. Hagaman, div. engr., 504 Eddy Bldg., Saginaw, 2 course gravel surfacing 12.637 mi. MO9-19C-2 and MO26-15C-2, Bay and Gladwin Counties, for State Hy. Comn., Lansing.

Michigan—Oct. 27, by H. W. Hagaman, div. engr., 504 Eddy Bldg., Saginaw, grading, drainage structures 10.856 mi. FO76-23C-2, Shiawassee Co., and 5.667 mi. FO56-20C-2, Midland Co., for State Hy. Comn., Lansing.

Michigan—Oct. 27, by W. J. Kingscott, div. engr., 309 McNair Bldg., Kalamazoo, grading, shaping, drainage structures, concrete paving 7.656 mi. FO 3-23C-3 Allegan Co., for State Hy. Comn., Lansing.

Michigan—Oct. 28, by H. G. Oakes, div. engr., Plymouth, grading, shaping, lengthening drainage structures, widening concrete paving 11.964 mi. MO63-29C-1, Oakland Co.—widening grade to 56 ft., lengthening drainage structures, replacing 0.488 mi. 18 ft. concrete paving on 10.112 mi. FO19-R Contr. 8, Clinton Co.—grading, drainage structures 6,189 mi. MO30-19C-2, Hillsdale Co., for State Hy. Comn., Lansing.

Michigan—Oct. 28, by H. G. Oakes, div. engr., Plymouth, grading, lengthening drainage structures 9.911 mi. FO50-24C-1 and FO50-24C-2, Macomb Co., for State Hy. Dpt., Lansing.

Michigan—Oct. 29, by A. L. Burridge, div. engr., Cadillac, grading, draining, shaping, 2 course gravel surfacing 9.192 mi. FO4-8C-1 and FO60-2C-2, Alpena and Montmorency Counties, for State Hy. Dpt., Lansing.

Michigan—Oct. 29, by A. L. Burridge, div. engr., Cadillac, grading, drainage structures 7.614 mi. FO1-10C-1 FO4-15C-1 and MO1-10C-2 Alcona and Alpena Counties, for State Hy. Comn., Lansing.

Michigan—Oct. 29, by A. L. Burridge, div. engr., Cadillac, grading, shaping, drainage structures, concrete paving 2.559 mi. FO53-10C-1, Mason Co., for State Hy. Comn., Lansing.

Minnesota—Nov. 10, by State Hy. Dpt., St. Paul, concrete paving 211,600 sq.yd. S. P. 2-34, Div B, F.A.P. 386-A, S.P. 2-28, Sect. 1 F.A.P. 86 and S P. 2-28 Sect. 2, F.A.P. 416-C—205,000 sq. yd., S.P. 2-40 Sect. 1, Div. A. F.A.P. 416-B—138,300 sq.yd. S.P. 2-40, Sect. 1, Div. B, F.A.P. 416-B and S.P. 2-40 Sect. 2 F.A.P. 416-A—89,800 sq.yd. S.P. 3-60, Sect. 2, F.A.P. 11 and S.P. 3-60

Constr. News page 150

Streets and Roads (Continued)

Sects. 3, F.A.P. 19—250,000 sq. yd. S.P. 7-23, F.A.P. 408-B, S.P. 7-44, F.A.P. 408-C and S.P. 7-27, Sect. 2, F.A.P. 408-D—193,000 sq. yd. S.P. 8-38, Div. B, F.A.P. 204, S.P. 8-35 F.A.P. 431 and S.P. 8-27, Div. A, F.A.P. 429—194,000 sq.yd. S.P. 20-36, F.A.P. 97.

Mo., Clayton—Oct. 28, by St. Louis Co., Court House, waterbound macadam paving Bernard Ave. from end present pavement to point 2,800 ft. easterly—rein.-con. paving 30,529 ft. Wild Horse Rd.—3,950 ft. Laclede Station Rd.—5,250 ft. Olive Street Rd.—9,100 ft. Woods Mills Rd.—graveling 1,700 ft. Horneker Rd. R. Jablonsky, Court House, co. engr.

Mo., Independence—Oct. 27, by Jackson Co., concrete paving 1 mi. Blue Spring Rd.—1.2 mi. Sin-Bar Cutoff—3.8 mi. Blue Ridge Cutoff—1 mi. 79th Rd.—9.2 mi. Raytown Rd.—7.9 mi. Noland St., all 18 ft. wide, Stayton & Veatch, 508 Mutual Bldg., Kansas City, engrs.

New York—Nov. 5, by Dpt. P. Wks., Div. Hys., State Office Bldg., Albany, F. S. Greene, supt. bituminous macadam paving 8.05 mi. New York World War Veterans Memorial Hy. (Wilmington-Mt. Whiteface), Essex Co.; adv. E.N.-R. Oct. 22.

N. Y., Brooklyn—Oct. 28, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, grading, curbing, flagging Kenmore Pl., Nostrand Ave. and West 5th St.—grading, granite block on concrete paving North 1st St.—grading, sheet asphalt on concrete paving Avenue P, Nostrand and Greene Aves East 39th, Elton, Harmon, West 5th, and 61st Sts.

N. Y., New York—Oct. 28, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., grading, curbing, sidewalks on East 156th St. and Leland Ave.

O., Wadsworth—Bd. of Control bids about Jan. 8, grading, asphaltic concrete paving Bergey, Water, East Fairlawn and Fairview Sts; $70,080.

Okla., Oklahoma City—Oct. 27, by M. Peshek, Jr., city clk., grading, paving 6 blocks Sawyer Ave. from 36th to 42nd Sts., 30 ft $27,560. L. M. Bush, City Hall, engr.

Pa., Phila.—Oct. 27, by Bureau Hys., Dpt. P. Wks., City Hall Annex, A. Murdock, dir., Schedule A, grading Dickens St. from 77th to 78th Sts., Vance St. from 82nd to 85th Sts., 82nd St. from Island to Vance Sts., Whitaker St. from Cayuga to Winghocking Sts.—Schedule B, asphalt paving (assessment work) Bigler St. from 10th to Marvine Sts., Hunting Park Ave. from K to M Sts.—Schedule C, paving and repaving alleys, driveways.

Tex., Brownsville—Nov. 6, by Cameron Co., c/o O. C. Dancy, judge, concrete paving 8.8 mi. A-44 San Jose Ranch Rd., 18 ft. W. O. Washington, Brownsville, co. engr.

Ontario—Oct. 24, by Dpt. Hys., Toronto, mixed macadam paving 3 4/5 mi. at Connaught Rifle Ranges easterly on Carling Ave., Ottawa, $67,000 — concrete, or mixed paving 6 mi. road from Belle River side road easterly, Ottawa-Pembroke Hy., Belle River $132,000—5¼ mi. road from end of concrete pavement southeast of Renfrew, easterly, Ottawa-Pembroke Hy. Renfrew, $122,000—5 4/5 mi. from end of penetration pavement southeast of Renfrew, southeasterly Ottawa-Pembroke Hy. Renfrew, $120,000—5 4/5 mi. road from Cobden westerly on Ottawa-Pembrake Hy. Cobden, $120,000—5.7 mi. road from Bobden southeast to concrete pavement on Ottawa-Pembroke Hy., Cobden $125,000—6 mi. Amperior westerly and easterly on Ottawa-Pembroke Hy. Amperior $134,000. R. M. Smith, Toronto, engr.

Ont., Thorold—See "Contracts Awarded."

CONTRACTS AWARDED

Ark., Mountain Home—Baxter Co., grading, gravel surfacing 8 mi. road between Forest and Cartney, by force account.

Ark., Russellville — Street Impvt. Dist. 11, grading, drainage structures, curbing, guttering, paving, to Mobley Constr. Co., $39,600.

California—R. E. Pierce, dist. engr. State Hy. Comn., Sacramento, planing existing asphaltic concrete surface on 8.8 mi. road between west boundary and point near Banta, San Joaquin Co., to Asphalt Pavement Planing Co., 1737 Webster St., Oakland, $4,331.

California—State Hy. Comn., Sacramento, C. H. Purcell, ch. engr., grading approaches to North Fork Trinity River Bridge, Trinity Co., to Skeels & Graham, Roseville, $27,097; grading, concrete surfacing road between Redwood City and Oregon Ave., San Mateo and Santa Clara Counties, to Basich Bros., 20550 Normandie Ave., Torrance, $406,625.

Calif., Los Angeles—Los Angeles Co., grading, curbing, sidewalks, 9-7-7-9 in. concrete paving 541,000 sq.ft., 3 in. asphaltic concrete paving 545,600 sq.ft., 6 in. asphaltic concrete with disintegrated rock and oil macadam base paving 143,000 sq.ft. Pomona Blvd., to Griffith Co., 502 Los Angeles Railway Bldg., $210,353. Noted Sept. 17.

Calif., Los Angeles—Los Angeles Co., grading, curbing, guttering, 8 x 6 x 6 x 8 in. concrete paving 196,025 sq.ft. Normandie Ave., to J. Papac, 726 North Hill St., $53,279.

Calif., Newport Beach—Curbing, water service pipes, oil macadam on 6 in. D.G. base paving 190,000 sq.ft. Seashore Dr., et al, to F. W. Teaschke, 3172 Cahuenga Ave., Los Angeles, $28,560. Noted Sept. 24.

Calif., Pomona—City Council, concrete paving 190,000 sq.ft. Fulton Rd., to H. H. Lienau, Anderson Bldg., San Bernardino, $36,484. Noted Sept. 3.

Calif., San Jose—H. Pfister, clk., Santa Clara Co., asphaltic concrete paving Congress Springs Rd. and Menker Ave., to J. H. Quimby, Burrell Bldg., $13,999 and $5,138, respectively.

Calif., Santa Ana — Orange Co., grading 125,000 cu.yd. Santiago Canyon Rd., to J. H. Dudley, 3738 Orange Ave., Long Beach, $30,926. Noted Sept. 24.

Connecticut—J. A Macdonald, hy. Comr., Hartford, waterbound macadam paving 6,700 ft. Cornwall, to Edgewood Concrete Co., 1376 Whalley Ave., New Haven, $31,277—1,053 ft. West Hartford, to Edward Balf Co., 17 Haynes St., Hartford, $5,235—trap rockmacadam paving 16,650 ft. Durham, to A. Brazos & Sons, Inc., 56 Oak St., Middletown, $14,127—gravel surfacing 18,200 ft. Mansfield, to Amos D. Bridges Sons, Hazardville, $13,556—treated gravel surfacing 12,500 ft. Weston, to A. Aldo, 470 North Ave., Bridgeport, $10,995—rolled gravel surfacing 12,500 ft. Windham, to R. H. Cone, 85 Lancaster Rd., West Hartford, $14,864. Grand total $90,054.

Connecticut—State Hy. Dpt., J. A. Macdonald hy. comr., Hartford, paving, improving sections of hy. in Enfield and Somers, to L. Suzio Constr. Co., State St., Meriden, Killingly and Pomfret, to M. A. Gamino Constr. Co., 728 Valley Rd., Providence, R. I.—Sterling, to K-Reet Installation Co., 82 John St., Hartford—South Windsor, to A. Brazos & Sons, 56 Oak St., Middletown—North Stonington, to N. Benvenuti & Sons, 6 Elm St., New London. Est. exceeds $25,000.

Idaho—A. Harbour, comr. P. Wks., Poise, grading, crushed graveling 5-, 3-mi. North and South Hy., between Naples and Bonner Co. line, Bonner Co., to C. Nyberg, Realty Bldg., Spokane, Wash., $44,666. Noted Oct. 2.

Indiana—State Hy. Comn., Indianapolis, concrete surfacing 0.88 mi. Federal Aid Project 263, Rd. 67, Marion Co., to J. R. Hiatt Co., 40 East 54th St., Indianapolis, $17,804. Est. $22,273. Noted July 9.

Indiana—J. J. Brown, dir., State Hy. Comn., grading culverts 2.931 mi. State Project 298-A, Rd. 64, Dubois Co., to J. Hoffman Co., 2626 North James St., Indianapolis, $26,158. Noted Aug. 20.

Ind., Crown Point—Lake Co., W. E. Whitaker aud., grading, drainage structures, concrete surfacing Anna A. Dickey Rd., to Public Constr. Co., Hammond, $67,900. Est. $110,000. Noted Sept. 17.

Ind., Indianapolis—Bd. P. Wks., concrete paving Auburn Rd., to Schwert Bros., $1,771—Bluff Ave., to Abel Bros., 402 Amer. Central Life Insurance Bldg., $3,102—Meridian St., to J. N. Morgan & Sons, 506 Inland Bank Bldg., $6,500—Walnut St., to R. M. Bowen, 4430 Carrolton St., $12,710—asphalt paving Georgia St., to Indiana Asphalt Paving Co., 2810 Columbia St., $2,911. Grand total $26,994.

Ind., Indianapolis—Bd. P. Wks., 8 in. concrete paving East New York St., to R. M. Bowen Co., 4430 Carrollton Ave., $41,144. Est. $60,000.

Ind., Salem—Washington Co., stone surfacing Albert Newby Rd., to F. Simpson, Salem $10,495; Rush Creek Rd., to E. E. Jones & Son, Madison, $13,995.

Iowa — State Hy. Com., Ames, grading, drainage structures 0.294 mi. road in Lyon Co., to C. W. McNamara, Sioux Falls, S. D. $1,396—gravel surfacing 10 mi. Decatupr Co., to Harvey Sand & Gravel Co., Harvey, $5,800—0.66 mi. Dubuque Co., to Dubuque Stone Products Co., Dubuque, $1,230—11.429 mi. Guthrie Co., to H. R. Maudlin, Nevada, $9,200—13.3 mi. Iowa and Benton Counties, to Builders Material Co., Cedar Rapids $28,894—4 mi. Louisa Co., to P. P. Hinote, Oakville, $3,360. Grand total $49,880. Noted Oct. 1.

Kentucky—State Hy. Dpt., Frankfort, grading drainage structures 9.77 mi. Covington-Morning View Rd., Kenton Co., incl. 212,220 lb. reinforcing steel, to Ashland Supply Co., Ashland, $97,263. Noted Sept. 3.

Kentucky—State Hy. Dpt., Frankfort, grading, drainage structures using 1st class rein.-con. pipe 7.121 mi. Walton-Verona Rd., Boone Co., to Carter, Carter & Braden, Clay $46,537—2.194 mi. Liberty-Sandy Hook Rd., Morgan Co., to H. H. Miller Constr. Co., Jackson, $20,638—traffic bound surfacing 4.792 mi. Princeton-Gracey Rd., Caldwell Co., to Corum Bros., Madisonville, $14,332. Grand total $81,507. Noted Oct. 8.

Kentucky—State Hy. Dpt., Frankfort, grading, drainage structures, using 1st class double strength pipe, 5.286 mi. Martin-Weaksbury Rd., Floyd Co., to Campbell-Johnson Co., Pikeville, $43,830. Noted Sept. 24.

La., Lafayette—Bd. City Trustees, widening, concrete paving Contr. 1, to Barber Bros. Constr. Co., Baton Rouge, $24,805; 1½ in. Duraco paving Contr. 2, to T. L. James & Co., Ruston, $23,442. Noted Oct. 1.

Maine—State Hy. Dpt., Augusta, grading and base 1.54 mi. hy. Carmel, to Richard Kennedy & Co., Portland, $28,504—bituminous macadam paving 2.78 mi. Westfield and Mars Hill, to A. D. Bridges & Sons, Hazardville, Conn., $63,200—concrete paving 0.94 mi. Milford to Wyman & Simpson, Augusta, $21,195. Grand total $112,899.

Maryland—State Roads Comm., G. C. Uhl, chm., Baltimore, concrete surfacing 0.51 mi. road in Prince George Co., to Christhilf & Ensey Co., 1625 Ridgely St., Baltimore, $9,361—1 mi. Montgomery Co., to M. J. Grove Lime Co., Lime Kiln, $22,025—1.33 mi. Dorchester Co., to Phillips Bros., Salisbury, $20,783—macadam surfacing 1.03 mi. Montgomery Co., to L. R. Waesche & Sons, Thurmont, $15,981. Grand total $68,150. Noted Sept. 24.

Maryland—State Roads Comm., G. C. Uhl, chm., Baltimore, concrete surfacing 1.5 mi. Contr. S-46-12, Somerset Co., to Hanneman-Burroughs Co., Salisbury, Md., $21,631—0.2 mi. Contr. M-188-32, to Loomis Constr. Co., 1014 Wisconsin Ave. N. W., Wash., D. C. $3,546—1 mi. Contr. M-187-53, to M. J. Grove Lime Co., Lime Kiln, $36,816—macadam surfacing 1.55 mi. Contr. M-182-52, to H. E. Gosnell & Co., Frederick, $21,392, all forgoing in Montgomery Co. Grand total $83,385. Noted Oct. 1 and 8.

Massachusetts—Dpt. P. Wks., State House, Boston, A. W. Dean, Dpt. P. Wks., engr., broken stone and tar surfacing 2,600 ft. hy. Salisbury, to W. S. Staples, Salisbury bituminous macadam paving, 2,061 ft. hy. incl. widening rein.-con. bridge, Ashby, to A. Pallotto, Bridge St., Dracut., $27,325. Noted Oct. 8.

Massachusetts—Dpt. P. Wks., A. W. Dean, engr., State House, Boston, gravel and tar surfacing 4,283 ft. hy. Northboro, and 3,687 ft. Phillipston, to Greenough Constr. Co., 200 Calvary St., Waltham, $11,713 and $8,045 respectively—4,292 ft. hy. Royalston, to R. E. Bull, 151 Harrison Ave., Fitchburg, $9,009—bituminous macadam paving 1,540 ft. Millis, to Perini & Ampollini, 242 Waverly St., Framingham, $11,634—983 ft. Grafton, to G. Bonazzoli & Sons, Hudson, $4,748—Type A, bitulithic concrete paving 14,016 ft. hy. Barnstable, to Lane Constr. Corp., 37 Colony St., Meriden, Conn., $58,494. Grand total $103,643. Noted Oct. 1.

Massachusetts—Dpt. P. Wks., A. W. Dean, engr., State House, Boston, bituminous macadam paving 18,227 ft. hy. Dedham, Westwood and Needham, to John Iafolla Constr. Co., Dedham, $331,155. Noted Sept. 24.

Mass., Attleboro—State Hy. Dpt., Boston, bituminous macadam paving Commonwealth Ave., to T. J. Quinn & Son, Ashton, R. I. Est. $25,000.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., bitulithic paving Ipswich St., Boston Proper, to A. Singarella, 22 Tremlett St., Dorchester, $30,183.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Washington St., to John McCourt Co., 910 Huntington Ave., $45,045.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Harlow St., Dorchester, to C. Frangioso & Son, 622 Cummins Hy., Mattapan, $20,075. Est. $25,000.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Amory and Boylston Sts., to H. F. Malley, 96 Tyndale St., West Roxbury, $36,833.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, bitulithic paving West Dedham St., Boston Proper, to M. DeMatteo, 55 Stella St., Roslindale. Est. $25,000.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Carlford Rd., to C. Struzziery, 115 Kittredge St., Roslindale. Est. $25,000.

Mass., Quincy—Metropolitan Dist. Comn., 20 Somerset St., Boston, bituminous macadam and granite block edging Furnace Brook Parkway, to A. DeStefano, 288 Summer St., East Boston, $20,211.

Mass., Westwood—Bd. Selectmen, Town Hall, grading, sheet asphalt surfacing Willow St., to J. Iaffols Constr. Co., 298 East St., Dedham. Rejected bids Sept. 30, grading, sheet asphalt surfacing Wells Ave. Total est. $25,000.

Michigan—W. J. Kingscott, div. engr., McNair Bldg., Kalamazoo, shaping, grading, drainage structures, concrete surfacing 0.542 mi. M11-9C-4 and 5, and 1.031 mi. FO11-9-C-3, Berrien Co., to J. R. Edelman Co., Muskegon Heights, 23,795 and $28,329 respectively. Noted Aug. 7.

Michigan—State Hy. Dpt., Lansing, widening, concrete paving 5.2 mi. MO70-39C-1, Ottawa Co., to Ottawa Conty Road Comm., Grand Haven, $32,283, concrete paving 0.263 mi. MO82-25C-1, Wayne Co., to Wayne County Road Comm., Michigan and Emerson Sts., Detroit, $10,874, grading gravel surfacing 5.5 mi. MO17-7C-4, and gravel surfacing 13.411 mi. MO17-C-4, Chippewa Co., to Chippewa County Road Comn., Sault Ste. Marie, $31,925 and $15,750 respectively. Grand total $90,832.

New Hampshire—State Hy. Dpt., Concord, grading, gravel surfacing 3.81 mi. hys. in Stewartson, Clarksville and Pittsburg, to John F. Rooney & Co., 154 Main St., Milford, Mass. Noted Sept. 24.

New Mexico—W. R. Eccles, state hy. engr., Santa Fe, grading 4.128 mi. New Mexico Federal Lands Hy., Project 2-A, and 6.101 mi. New Mexico Federal Lands Hy., Project 1, to E. J. Maloney, Gallup, $109,195 and $84,916 respectively. Noted Oct. 1.

N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, to Concrete Co., Metropolitan Ave., grading Bragg St. $1,583; Avenue V $2,878—to J. and M. Moran, 413 Sterling Pl., Ditmas Ave. $3,001—to D. J. McCoy Asphalt Co., Avenue U and East 57th St., asphalt paving East 28th St., $5,511; East 35th St., $6,374; Troy Ave. $5,962;

Constr. News page 151

Streets and Roads (Continued)

West 3rd St. $3,654—to W. J. McHale, 1250 Jefferson Ave., grading Ave., grading West 12th St., $2,069; 15th Ave. $2,057. Grand total $33,089. Noted Sept. 24.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., grading 119th Ave., to F. Gargiso, $3,646. Noted Sept. 24.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., grading Horace Harding (Nassau) Blvd., to Welsh Bros. Contg. Co., Inc., 27 Purvis St., $349,850. This corrects report in Sept. 3 issue.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., sheet asphalt on concrete paving Convent Ave. and Pearl St., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., $4,697 and $4,078 respectively—sheet asphalt paving Beekman St., to Meehan Paving Co., 90 West St., $2,095. Grand total $10,870. Noted Oct. 1.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., regulating Turnbull Ave. to Mansboro Contg. Co., 2861 Harrington Ave., $9,000—Ely Ave., to S. LaBarbera, 65 Webster Ridge, New Rochelle, $7,153—Netherland and Van Nest Aves., to M. Del Balso, 2551 Cruger Ave., $5,719 and $10,126 respectively—Pearsall Ave., to A. Large, Jr., $4,208—Hoxie St., to Perotto Contg. Co., $1,275—sewer in Holland Ave., to D. DiGiacco, $2,965. Grand total $40,446. Noted Oct. 1.

O., Cleveland Heights (Cleveland P. O.)—City Council, paving Monticello Blvd., Pembrook, Rushleigh, Hazelton and Castleton Rds., to Cleveland Trinidad Paving Co., Western Reserve Bldg., Cleveland, $75,473.

O., Wooster—Wayne Co., hard-surfacing Marshallville-Western-Smithville, Wielersville-Orrville-Smithville, Rds., to Bardin & Diana, Canton, $25,882, Est. $35,000.

Pa., Pittsburgh—R. G. Woodside, controller Allegheny Co., grading curbing, paving 1,050 ft. in Pitcairn Boro, to R. H. Cunningham & Sons, 125 Grant Ave., Turtle Creek, $16,887—rein.-con. paving 800 ft. Union Ave., Oakdale Boro, to J. L. Plumer, State St., Oakdale, $9,607—test borings for Bridge 12, Homestead, over Monongahela River, to Pennsylvania Drilling Co., 1201 Chartiers Ave., Pittsburgh, $4,607—slag surfacing road between Lowrie Run and McGee Rds., and from Emsworth to Mt. Nebo, Franklin Twp., to D. W. Challis & Sons, Continental and Locust Sts., Sewickley, $29,000. Grand total $60,101. Noted Sept. 3.

Pa., Pittsburgh—City Council, grading, curbing, paving Antenor Ave. and Michigan St., to D. Pavia, 331 Ladson St., $28,533—grading, paving Haslage and Iowa Sts., to A. F. Jordano, 1201 West Liberty Ave., $2,488 and $10,431 respectively — gunite work on 28th St. Bridge, to Cement Gunite Co., Fulton Bldg., $7,470—repairing Independence St. Bridge, to Speaker Constr. Co., Commonwealth Annex, $650—repairing South Main St. Bridge, to A. Hanson Eng. & Constr. Co., Pittsburgh, $1,505—9 and 15 in. terra cotta sewers, brick manholes, catch basins in Gifford and McCook Sts., to F. Manella, 1507 North Lang St., $1,793—15 in. trrra cotta sewers in Hunt St., and Glen Manor Ave., to Schenley Constr. Co., 40 Boundary St., $4,039—in Sorrell & McCook Sts., to V. Valeno & Sons, 701 Hays St., $1,290, in Passage Way and Allequippa St., to J. and R. Very, 701 Hays St., $667. Grand total $58,866.

Rhode Island—State Bd. P. Roads, State House, Providence, rein.-con. paving 6.2 mi. South County Trail, South Kingstown-Richmond-Charlestown, Contr. 3103, F.A.P. 65, to Lane Constr. Corp., 37 Colony St., Meriden, Conn., $219,863; bituminous macadam penetration method paving 2.5 mi. Ocean Rd., Narragansett, Contr. 3112, to B. C. Jordan, 75 Westminster St., Providence, $40,380. Noted Oct. 1.

Texas—State Hy. Dpt., Austin, grading bridging 13.569 mi. Hy. 71, Colorado Co., to Standifer Bros., Big Wells, $34,484; 15.152 mi. Hy. 6, Brazos Co., to Valley Dredging Co., Donna, $126,989.

Washington—S. J. Humes, dir. State Hy., Olmpyia, improving 40.722 mi. Purdy Creek-Junction State Rd., Mason Co., to A. Besoloff, 1715 12th Ave., Seattle, $111,609; 8.283 mi. Montesano-Aberdeen Rd., Grays Harbor Co., to E. C. Peck & Co., Hoquiam, $186,261. Noted Sept. 17.

Ont., Ottawa—City Council, widening, paving Carling Ave. from Bronson Ave. to city limits, to O'Learys, Ltd., Rideau St., $33,700.

Ont., Thorold—Town Council, concrete paving Water, Albert, Maitland, Richmond and Regent Sts., day labor under supervision town engineers. $35,000.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Ind., Auburn—Surveyor De Kalb Co. soon takes bids improving 18 mi. Cedar Creek Draiage. C. C. Kain, engr.

Constr. News page 152

Ind., Michigan City—Bd. P. Wks., City Hall, C.S.C.R. new docks along harbor from Michigan City Central railroad bridge west to harbor entrance, incl. deepening harbor to 20 and 22 ft. depth, $362,944. H. R. Peterson, city engr. Noted Oct. 15.

Tex., Port Isabel—Del Mar Inc., c/o S. A. Robertson, San Antonio, 13,000 ft. channel extending from inner end Brazos Santiago Pass, south along Brazos Island to west shore, incl. two 2,000 ft. entrance channels, 2 and 3 ft. depth. Address owner.

BIDS ASKED

Massachusetts—Oct. 27, by Dpt. P. Wks., State House, Boston, furnishing placing 2,900 tons stone rip rap and chips, and 340 cu.yd. sand fill in 3 separate locations at Menamsha Inlet, Chilmark and Gay Head. A. W. Dean, Dpt. P. Wks., Boston, engr.

CONTRACTS AWARDED

Calif., Los Angeles—Flood Control Dist., 202 North Bway., Los Angeles River protection, Dayton Ave. to Fletcher Dr., incl. 410,000 sq.ft. guniting levee slopes and special gunite work, 305,000 sq.ft. pre-cast concrete block mat. complete, 210 cu.yd. rein.-con. drainage structures, incl. excav., to C. Anili Co., 2817 57th St., Huntington Park, $45,142. District will furnish cement, reinforcing steel, reinforcing bars, toe concrete blocks.

Ill., East St. Louis—East Side Levee & Sanitary Dist., 217 Metropolitan Bldg., furnishing, replacing 25,000 sq.yd. revetment on levee of Project 7, incl. 2,000 cu.yd. excav. for footings and grading levee, to H. H. Hall Constr. Co., Murphy Bldg., $58,800. Noted Aug. 27.

Louisiana—State Hy. Comn., Baton Rouge, to L. B. LeBlanch Constr. Co., St. Gabriel, 0.8 mi. emergency levee, incl. graveling roads along Bayou Current Levee, St. Landry Parish $2,947, 4.4 mi. along St. Gabriel Levee, Iberville Parish, $23,129, 1.1 mi. along Darrorwsville Levee, Ascension Parish, $5,860; to B. W. Compton, Elba 1.1 mi. along Woodside Levee, Avoyelles and St. Landry Parishes $4,390; 0.9 mi. along St. Joseph Levee, St. Landry Parish $3,325; to Laiche & Miller, Morganza, 3.3 mi. along Waterloo Hermitage Levee, West Baton Rouge Parish $21,256, 3.3 mi. along Missouri Bend Levee $19,189, 2.7 mi. along Hermitage-Waterloo Levee, Pointe Coupee Parish $16,916; to Hoffman & Jones, Madisonville, 4.4 mi. along Chamberlain-Lobdell Levee $26,085; to Tircuit & Co., Plaquemine, 1.8 mi. along Allen-Brusby Levee, $11,059. Grand total $134,156.

Louisiana—Bd. State Engineers, 207 New Orleans Court Bldg., New Orleans, Fort Jackson to Jump-Back Protection Levee, Buras Levee Dist. incl. 150,000 cu.yd. excav., to McWilliams Dredging Co., Canal Bank Bldg., New Orleans, at $0.185 per cu.yd.; Triumph Levee in Buras Levee Dist., Plaquemines Parish, to A. A. Buras, 3128 De Soto St., New Orleans, at $0.33 per cu.yd. Noted Sept. 17.

La., Lake Charles—Gravity D. D. Es. Cameron Parish, main drainage canals, laterals, incl. 160,000 cu.yd. excav., to Lake Arthur Dredging Co., Beaumont, Tex.

Mass., Boston—Park Dpt., 33 Beacon St., dredging, filling, bulkhead at airport, East Boston, to R. C. Huffman Constr. Co., Terminal Tower Bldg., Cleveland, O., $490,500. Noted Sept. 24.

Mich., Saginaw—Improving Misteguay Creek Drain, incl. 350,250 cc.yd. exca., to C. Erickson, Pinconning.

N. Y. Brooklyn—J. McKenzie, comr. Docks, Pier "A", Battery Pl., New York, dredging Paerdagat Basin, Jamaica Bay, Contr. 2047, to Atlantic, Gulf & Pacific Co., 13 Park Row, New York, $279,215. Noted Sept. 24.

Que., Louisville—Dpt. P. Wks., Ottawa, K. M. Cameron, engr., dredging, to Francis River Dredging Co. Ltd., Pierreville, $11,500.

Bond Elections

Coming Bond Elections

Water Distribution System—Cambria, Calif., San Luis Obispo Co., Water Dist. 3, $18,000.

Waterworks — Hartford, Conn., Metropolitan Dist., Conn., Nov. 3, $8,500,000.

Rehabilitation Water Plant—Decatur, Ill., election soon, M. P. O'Brien, City Hall, engr. $275,000.

Water Supply—Versailles, Ky., Nov. 3, $50,000.

Waterworks—Elbridge, N. Y., Oct. 21, $52,000.

Waterworks System — Roseville O., Nov. 3, $40,000.

Main Extensions—Shawnee, Okla., Nov. 3, T. E. Thompson, engr. $200,000.

Storm Sewerage System, Bridge over Rock River and Two High Schools — Rockford, Ill., $3,000,000.

High and Elementary School Units—Claremont, Calif., $198,000.

High School—North Sacramento, Calif., Grant Union High School Dist., $150,000.

Power Plant — Starkville, Miss., Oct. 31, $102,000.

Electric Light Plant — Shelby, O., Nov. 3, $85,000.

Bonds Voted

Sewers and Disposal Plant — New Rich Wis., $44,000.

Garbage Incinerator—Maywood, Ill., $75,000

Junior High Schools — Sacramento, Calif., $1,146,000.

Schools—Greenport, N. Y., Southold Union Free Dist., $550,000.

School—Northbridge School Dist., Ohio, $170,000.

Bonds Defeated

Sewers and Disposal Plant—Mundridge, Kan., $40,000.

Sewers—McKeesport, Pa., $30,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Calif., Alameda — DUCT LINES — Pub. Bldg., 461 Market St., San Francisco, constructing Unit 4, power duct lines in connection with improvements at Government Island.

Calif., Beverly Hills—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by R. C. Flewelling, 450 North Beverly Dr., and Allison & Allison, 1005 Calif. Reserve Bldg., Los Angeles, steel, masonry, post office. $300,000.

Calif., Los Angeles—FEDERAL BUILDING—Treas. Dpt. at office Sup. Archt., plans by J. C. Austin & F. M. Ashley, Chamber of Commerce Bldg., and D. B. Parkinson, Title Insurance Bldg., 12 story federal building. $5,650,000.

Calif., Los Angeles—POST OFFICE—Treas. Dpt. at office Sup. Archt., post office $2,500,000.

Ind., Plymouth—POST OFFIE—Treas. Dpt. at office Sup. Archt., rein.-con. post office.

Ia., Sioux City—POST OFFICE—Treas. Dpt. at office Sup. Archt., bids early in 1932, 4 story, basement, brick, steel, concrete, stone, 6th and Douglas Sts. $775,000. Beuttler & Arnold, 407 Insurance Exc. Bldg., Sioux City and Proudfoot, Rawson, Souers & Thomas, 810 Hubbell Bldg., Des Moines, archts. Noted July 9.

Mass., Salem—POST OFFICE—Treas. Dpt. at office Sup. Archt., soon takes bids 1 story brick, stone, 38,000 sq.ft. floor space, Margin Creek and Norman Sts. $360,000. Smith & Walker, 80 Boylston St., Boston, archts. Noted Aug. 6.

Mass., Waltham—POST OFFICE—Treas. Dpt. at office Sup. Archt., soon takes bids 1 story basement, mezzanine, brick, stone, Main and Grant Sts. $320,000. Wadsworth, Hubbard & Smith, 11 Beacon St., Boston, archts. Noted Apr. 30.

Minn., Mankato—POST OFFICE—Treas. Dpt. at office Sup. Archt., remodeling and constructing 2 story, basement, rein.-con., brick addition $300,000.

Miss., Jackson—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by Hull & Malvaney, Merchants Bank Bldg., 5 story, 132 x 152 ft., concrete, steel, stone. Capitol, West and Pearl Sts. $710,000 available. Noted Apr. 30.

N. Y., Port Chester—POST OFFICE—Treas. Dpt. at office Sup. Arch., plans by Zoller & Muller, 441 Lexington Ave., U. S. Post Office Westchester Ave. $200,000.

Okla., Ponca City—POST OFFICE—Treas. Dpt. at office Sup. Archt., soon takes bids 1 story, basement, 100 x 150 ft., rein.-con., brick steel, stone. $250,000. J. D. Forsythe, Exchange Natl. Bank Bldg., Tulsa, and D. McCormick, 1242 South Boston St., Tulsa, assoc. archts.

Ore., Portland—DIKES—U. S. Eng. 9,040 lin.ft. dikes, at 5 sites in Columbia River, incl 143,388 lin.ft. piling, 66,704 B.M. lumber, 25,397 lb. hardware, 28,810 cu.yd. stone.

Pa., Greenvile—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by Clepper & Clepper, McDowell Bank Bldg., Sharon, 1 story basement, 142x171 ft., brick, stone, Clinton and Canal Sts. $175,000. Noted Dec. 18.

Pa., Midland—LOCK—U. S. Eng., Keenan Bldg., Pittsburgh, preliminary plans concrete steel lock and dam. $2,000,000.

Texas—DREDGING—U. S. Eng., Galveston 8,500,000 cu.yd. in Sabine River-Galveston Sect. Louisiana and Texas Intracoastal Waterway.

Texas—DREDGING—U. S. Eng., Galveston rejected bids Aug. 10, 377,000 cu.yd. Sabine-Neches Waterway. Noted July 16.

Tex., Galveston—IMMIGRATION STATION—Treas. Dpt. at office Sup. Archt., soon takes bids 3 story, basement, brick, tile, 17th and 18th Sts. $375,000. Bottomley, Wagner & White, 60 East 42nd St., New York, archts. Noted Aug. 6.

Vt., Alburg—STATION—Treas. Dpt. at office Sup. Archt., border station.

BIDS ASKED

Ark., North Little Rock—POST OFFICE—Nov. 6, by Treas. Dpt. at office Sup. Archt U. S. Post Office. $110,000.

Federal Government (Continued)

Calif., Berkeley—ELEVATOR—Nov. 6, by Treas. Dpt. at office Sup. Archt., elevator in U. S. Post Office.

Conn., New Haven—GREEN HOUSE, etc.—Oct. 30, by Dpt. Agriculture, greenhouse and special heating plant, Marsh Botanical Gardens. Cir. 530. Noted Aug. 6.

Del., Georgetown—Oct. 27, by Treas. Dpt. at office Sup. Archt., U. S. Post Office. $75,000.

D. C., Wash.—HOSPITAL—Nov. 17, by Dpt. Interior, 2 continued treatment buildings.

Florida—GROIN, etc.—Nov. 5, by U. S. Eng., Jacksonville, constructing groin, repairing south jetty at entrance St. John's River.

Fla., Jacksonville—ELEVATOR PLANT—Oct. 26, by Treas. Dpt., at office Sup. Archt., elevator plant, at U. S. Parcel Post Building.

Fla., Miami—POST OFFICE, etc.—Oct. 30, by Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Post Office and Court House; adv. E.N.-R. Oct. 22.

Illinois—EARTHWORK—Oct. 28, by U. S. Eng., 428 Customhouse, St. Louis, Mo., replacing 2,275,000 cu.yd. earthwork in rebuilding, enlarging levee Keach Drainage and Levee Dist., Greene Co., on Illinois River; adv. E. N.-R. Oct. 22.

Ill., Aurora — POST OFFICE — Nov. 3, by Treas. Dpt., at office Sup. Archt., U. S. Post Office. $395,000.

Ill., Chicago—CONTROL HOUSES—Oct. 30, by U. S. Eng., 333 North Michigan Ave., 3 brick control houses for locks on Illinois River at Lockport, Marseilles and Starved Rock; adv. E.N.-R. Oct. 22.

Ill., Chicago — ELECTRIC EQUIPMENT — Nov. 16, by U. S. Eng., 333 North Michigan Ave., electrical power, control and indicating equipment, lock signals, lock exterior illuminating equipment, lock gallery recess and shelter illuminating equipment, electric cable, connection boxes, potheads, other appurtenances, at Lockport, Marseilles and Starve Rock Locks, on Illinois Waterway; adv. E. N.-R. Oct. 22. Noted Sept. 24.

Ind., Evansville—HOSPITAL—Treas. Dpt. at office Sup. Archt., bids about Dec. 30, 3 story, basement, rein.-con., brick, stone. $100,000.

Ind., Mount Vernon—POST OFFICE—Nov. 9, by Treas. Dpt. at office Sup. Archt., U. S. Post Office; adv. E.N.-R. Oct. 22.

Kan., Ottawa—REMODELING, etc.—Nov. 3, by Treas. Dpt., at office Sup. Archt., remodeling, enlarging U. S. Post Office; adv. E.N.-R. Oct. 22.

Ky., Bowman Field—HANGAR—Nov. 3, by Con. Q. M. air corps double hangar with annexes for boiler house annex. $61,207.

La., New Orleans—EARTHWORK—Oct. 27, by U. S. Eng., Prytania and River Sts., 270,000 cu.yd. earthwork in 2nd New Orleans Levee Dist.

La., Shreveport—DRAIN SYSTEM—Nov. 6, by Con. Q.M., Barksdale Field, storm drain system, at Barksdale Field; adv. E.N.-R. Oct. 22.

Minn., Hastings—CLEARING—Oct. 30, by U. S. Eng., 615 Commerce Bldg., St. Paul, 5,139 acres land laying in pool area above Mississippi River, Lock and Dam 2; adv. E.N.-R. Oct. 22.

Miss., Aberdeen—POST OFFICE, etc.—Nov. 5, by Treas. Dpt. at office Sup. Archt., extending, remodeling U. S. Post Office, Court House, etc.; ad. E. N. R. Oct. 22. Noted Oct. 1.

Missouri—CLUMP DIKES—Oct. 26, by U. S. Eng., 428 Custom House, St. Louis, 5,700 lin. ft. standard pile clump dikes in Missouri River, Pelican Bend, mile 12 to mile 16 above mouth of river; adv. E.N.-R. Oct. 22.

Missouri—DIKES, etc.—Nov. 9, by U. S. Eng., Kansas City, 7,410 lin.ft. standard clump dikes in Missouri River, at Gasconade River Bend, and McGirks Island Reach, center of work about 2 mi. downstream from Gasconade; 3,480 lin.ft. at Wayne City Bend, center of work 2 mi. down stream from Cement City; 2,900 lin.ft. standard revetment at Eureka and Marion Bends, center of work ½ mi. upstream from Marion.

Missouri—PILE DIKES—Nov. 10, by U. S. Eng., Postal Telegraph Bldg., Kansas City, 10,580 lin. ft. clump and batter pile dikes in Missouri River, at Grand River and Bushwhacker Bend, 2.5 mi. upstream from New Frankfort; 6,610 lin. ft. standard pile clump dikes in Missouri River at Straubs and Gasconade River Bends, 2 mi. upstream from Gasconade.

Missouri—CLUMP DIKES, etc.—Nov. 11, by U. S. Eng., 700 Postal Telegraph Bldg., Kansas City, 9,865 lin. ft. standard pile clump dikes and 3,000 lin. ft. standard revetment in Missouri River at McGirks Island and Hermann Reaches center of work being 1.3 mi. upstream from Hermann; 5,120 lin. ft. standard pile clump and standard batter pile dikes and 2,100 lin. ft. standard revetment in at Malta Bend, center of work being 14 mi. downstream from Waverly.

Missouri—CLUMP DIKES—Nov. 12, by U. S. Eng., 700 Postal Telegraph Bldg., Kansas City, 6,600 lin.ft. standard pile clump dikes in Missouri River, at Miami, DeWitt and Brunswick Bends, center of work being 3 mi. downstream from DeWitt 9,365 lin.ft. at Chamois Reach and Chamois Bend, center of work being 0.5 mi. from Chamois.

Missouri — CLUMP DIKES — Nov. 13, by U. S. Eng., 700 Postal Telegraph Bldg., Kansas City, 5,200 lin.ft. standard pile clump dikes in Missouri River at Moberly Bend, Waverly Reach and Waverly Bend, center of work being 2.8 mi. upstream from Waverly; 7,520 lin.ft. standard clump dikes at Rising Creek Bend and Cote Sans Dessein Reach, center of work being 0.5 mi. upstream from Osage City.

Mo., Lebanon—POST OFFICE—Oct. 28, by Treas. Dpt. at office Sup. Archt., U. S. Post Office. $70,000.

Mo., St. Charles—DIKES—Oct. 25, by U. S. Eng., St. Louis, 5,700 lin.ft. standard pile dry dikes, incl. 5,000 sq.yd. lumber on willow mattress, 8,200 cu.yd. stone, 125,000 ft. piles and stringers, in Missouri River, at Pelican Bend, 15 mi. below here.

N. H., Manchester—ELEVATOR—Oct. 28, by Treas. Dpt. at office Sup. Archt., freight elevator in U. S. Post Office.

N. C., Fort Brass—STREETS, etc.—Nov. 12, at office Con. Q.M.; concrete streets, cribbing, guttering, sidewalks, drainage, grading; adv. Oct. 22.

O., Chillicothe—HOSPITAL—Nov. 10, by Vet. Bu., Arlington Bldg., building additions, utilities.

O., Dayton—HANGAR—Oct. 27, by Con. Q.M., Wright Field, hangar, Wright Field.

Okla., Fort Sill—HANGAR—Oct. 30, by Con. Q. M., new airport hanger. $55,000; adv. E.N.-R. Oct. 22.

Texas — DREDGING — Nov. 24, by U. S. Eng., Galveston, 8,468,500 cu.yd. Louisiana and Texas Intracoastal Waterway, through Chambers and Galveston Counties, from U. S. Reference Line Sta. 1625, near High Island to Reference Line Sta. 3136, Galveston Bay, near Port Bolivar; adv. E.N.-R. Oct. 22. Noted Oct. 1.

Tex., Freeport—DREDGING—Nov. 11, by U. S. Eng., Galveston, 335,000 cu.yd. from Freeport Harbor.

Tex., San Benito—POST OFFICE—Nov. 9, by Treas. Dpt. at office Sup. Archt., U. S. Post Office. Noted June 11.

Utah, Nephi—POST OFFICE—Nov. 11, by Treas. Dpt. at office Sup. Archt., U. S. Post Office; adv. E.N.-R. Oct. 22.

Va., Langley Field—WATER LINES, etc.—Nov. 5, by Con. Q. M., municipal water and sewer lines for 20 double non-commissioned officers' quarters, barracks and service club building.

Va., Langley Field—WATER MAINS, etc.—Nov. 9, by Con. Q. M., water mains, sanitary sewer for hangar; adv. E.N.-R. Oct. 22.

Wash., Port Angeles—POST OFFICE—Nov. 18, by Treas. Dpt. at office Sup. Archt., U. S. Post Office $190,000.

CONTRACTS AWARDED

Ala., Montgomery—STABLE — Con. Q.M., 1 stable for 64 animals at Maxwell Field, to Smith-Pew Constr. Co., Atlanta, Ga., $17,850. Noted Sept. 10.

Ark., Fayetteville — REMODELING — Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Post Office, to Roach-Lecontour Constr. Co., St. Louis, Mo., $14,874. Noted Sept. 10.

Calif., Richmond—DREDGING—U. S. Eng., Custom House, San Francisco, 855,680 cu.yd. Richmond Harbor, to Standard Dredging Co., Oakland, $93,868. Noted Aug. 20.

Colo., Monte Vista—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Kellogg & Anderson, Sedalia, $108,451. Noted Sept. 10.

Conn., Bridgeport—CLEARING SITE, etc.—Treas. Dpt. at office Sup. Archt., clearing site, erecting fence for U. S. Post Office, to J. J. Abramson, Bronx Park S., New York, $2,300. Noted Sept. 11.

Ga., Augusta—CLINICAL BUILDING—U. S. Vet. Bu., Arlington Bldg., clinical building, to J. S. McCauley & Co., 612 Bona Allen Bldg. Atlanta, $297,765. Noted Sept. 3.

Kansas—HANGAR—Con. Q. M., Fort Riley, 1 story, 120x243 ft. hangar, two 22x40 ft. annexes, 21x44 ft. boiler house, at Fort Riley, to Herman Eng. Co., 844 North Rush St., Chicago, Ill., $53,707. Noted Sept. 3.

Ky., Louisville—REVETMENT—U. S. Eng., P. O. Box 72, 2,300 lin.ft. bank revetment in Ohio River, Stewarts Island, to Kansas City Bridge Co., 215 Pershing Rd., Kansas City, Mo., $62,902. Noted Sept. 3.

Md., Baltimore—DREDGING—U. S. Eng., 1,050,600 cu.yd. in Craighill section of channel, to Arundel Corp., Pier 2, Pratt St., $98,756. Noted Aug. 20.

Md., Fort George Meade—ROADS—Con. Q. M., main concrete roads, to Caton Constr. Co., Halethrope, $7,813. Noted Sept. 14 Daily.

Mass., Falmouth—WHARF REPAIRS—Lighthouse Dpt., Marginal St., Chelsea, wharf repairs, to Rendle Corp., 230 Meridan St., East Boston, $4,060.

Mass., Hingham — RAILROAD TRACKS — Spec. 6663—Yards & Docks, Navy Dpt., repairing railroad tracks, to Hill & Delaney, 108 Massachusetts Ave., Boston. Noted Sept. 24.

Mich., Selfridge Field—BOILER HOUSES—Con. Q. M., boiler houses, to Banbrook-Gawan Co., 4829 Woodward St., Detroit, Mich., $93,870. Noted Aug. 13.

Missouri—CLUMP DIKES—U. S. Eng., 428 Custom House, St. Louis, 2,500 ft. standard pile clump dikes and 700 ft. crib dikes in Missouri River, at Hinkles Bend, to Woods Bros. Constr. Co., 133 South 13th St., Lincoln, Neb., $55,550 and $28,247 respectively. Noted Sept. 24.

Missouri—PILING DIKES—U. S. Eng., 428 Custom House, St. Louis, 1,500-4,000 ft. piling dikes in Missouri River between Miles 30 and 35, at Springhouse Bend, to Massman Constr. Co., Amer. Bank Bldg., Kansas City, $46,225. Noted Sept. 17.

Missouri—REVETMENT—U. S. Eng., 428 Custom House, St. Louis, 4,000 to 9,500 lin.ft. revetment in Missouri River between Miles 30 and 35, above mouth at Springhouse Bend, to Massman Constr. Co., Amer. Bank Bldg., Kansas City, $73,805. Noted Sept. 17.

Mont., Helena—FEDERAL OFFICE—Treas. Dpt. at office Sup. Archt., federal office building addition, to C. Weitz Sons, 713 Mulberry St., Des Moines, Ia., $314,694 (450 days); elevator plant, to Otis Elevator Co., 810 18th St., Wash., D. C., $13,251. Noted July 7.

Neb., Lincoln—GREENHOUSE—Vet. Bu., Arlington Bldg., 30x70 ft. iron, frame, glass greenhouse, to G. Foley Greenhouse Mfg. Co., Forest Park, Ill.

Nev., Boulder City—PURIFICATION PLANT, etc.—Bureau Reclamation, Las Vegas, water purification and sewage disposal plants, to Stearns-Rogers Mfg. Co., Los Angeles, Calif., and 1638 Calif. St. Denver Colo. $37,930. Noted Sept. 24.

N. H., Portsmouth—REFIGERATION EQUIPMENT—Spec. 6634—Yards & Docks, Navy Dpt., refrigerating equipment for Navy Yard, to Frigidaire Corp., 3rd Natl. Bldg., Dayton, O. Noted Sept. 3.

N. Y., Mineola—QUARTERS—U. S. Eng., bachelors' and non-commissioned officers' quarters, to Shawmut Constr. Co., 294 Washington St., Boston, Mass., $264,360. Noted Oct. 1.

N. Y., New York—APARTMENT—Con. Q.M., non-commissioned officers' apartment, Fort Jay, to J. R. and J. A. Whalen, $328,000. Noted Oct. 2 Daily.

N. D., Ambrose—INSPECTION STATION—Treas. Dpt. at office Sup. Archt., inspection station, to G. H. Lounsberry, 322½ East Superior St., Duluth, Minn., $42,078. Noted Sept. 3.

Oregon — BRIDGES — Pub. Rds., Custom House, Portland, Bridges in Santiam Natl. Forest, Marion Co., to T. Lillaho, Reedsport, $13,061. Noted Oct. 6.

Va., Norfolk—DREDGING—U. S. Eng., Scotts Creek, Norfolk Harbor, incl. 107,369 cu.yd. material plus 20,782 cu.yd. overdepth, 128,151 cu.yd. measurement, to Akinson Dredging Co., 507 Florida Theatre Bldg., Jacksonville, Fla.

Wash., Sumas—INSPECTION STATION—Treas. Dpt. at office Sup. Archt., inspection station, to J. Barkost, 2906 North Union St., Tacoma, $36,700 (300 days). Noted Aug. 6.

RAILWAYS

BIDS ASKED

Indiana—See "Contracts Awarded."

CONTRACTS AWARDED

Indiana—Indiana Serv. Corp., Huntington, 3 spur tracks in Huntington, own forces. Private plans.

SUBWAYS AND TUNNELS

BIDS ASKED

Pa., Phila.—See "Equipment."

GRADE CROSSINGS

PROPOSED WORK

Ala., Birmingham—For 100 ft. concrete viaduct, 50 ft. driveway, two 10 ft. sidewalks over Southern R.R. and St. Louis & San Francisco R.R., at 27th St. and 11th Ave. N. $21,000. A. J. Hawkins, city engr.

N. Y., Rochester—New York Central R. R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., New York, and Buffalo, Rochester and Pittsburgh Ry. Co. E. F. Robinson, ch engr., Rochester, eliminating grade crossings at Ames and Child Sts., $664,300 and $492,000 respectively, constructing pedestrian subways at Colvin, York and Hague Sts., $43,000-$88,600.

BIDS ASKED

Ky., Newport—Chesapeake & Ohio R. R. Co., Richmond, Va., C. R. Johns, ch. engr. bids about Nov. 14, 10 span 700 ft. concrete grade crossing elimination at Monmouth St. $700,000. F. L. McLane, mayor.

Michigan—Oct. 27, by H. G. Oakes, div. engr., Plymouth, Grade Sept. 1 of 63-3-10, Contr. 3 and 4, 160 ft. long, 2 rein.-con. abutments, counterfort type, steel deck girder (rolled beams) with rein.-con. flooring, surfacing and railing, two 6 ft. sidewalks, Oakland Co., for State Hy. Comn., Lansing.

Michigan—Oct. 30, by W. J. Kingscott, div. engr., 213 Watson Bldg., Grand Rapids, 2 pedestrian underpasses, Mo41-31, C-2, Kent Co., for State Hy. Dpt., Lansing.

Tex., Dallas — Oct. 27, by Union Terminal Co., Houston St., approaches, rein.-con. underpass at railroad, Corinth St.

CONTRACTS AWARDED

Mass., Quincy—New York, New Haven & Hartford R.R. Co., Hartford, Conn., E. E. Oviatt, ch. engr., grade crossing elimination, to Tredennick-Billings Co., 10 High St., Boston, $55,000.

Tex., Ballinger—Runnels Co., 3 span 120 ft. concrete overpass, incl. thirteen 52 ft. and three 40 ft. I-beam spans, 22 ft. roadway, Hy. 23, Federal Aid Project 600-A, to D. F. Jones Constr. Co., Little Rock, Ark., $63,518.

Constr. News page 153

DAMS

PROPOSED WORK

Calif., Napa—State Dpt. P. Wks., Sacramento, surveys dam in Rector Canyon in Napa Hills to provide water supply for state institutions in vicinity. $1,000,000.

Calif., Pasadena—See "Waterworks."

PIERS AND WHARVES

BIDS ASKED

N. Y., New York—PIERS—Oct. 29 (extended date), by Dpt. Docks, J. McKenzie, comr., Pier "A", Battery Pl., new piers foot West 48th, 50th and 52nd Sts., North River. Contr. 1953. Noted Oct. 15.

CONTRACTS AWARDED

Ont., Port Hope—WHARF—Dpt. P. Wks., Ottawa, K. M. Cameron, engr., 314 lin.ft. wharf, to R. C. Huffman Constr. Co., 331 Bay St., Toronto, $19,066.

AIRPORTS

CONTRACTS AWARDED

Mass., Boston—Commonwealth of Massachusetts, Armory Comn., J. H. Agnew, chn., 1 and 2 story, 180x200 ft., brick, steel air corps building (adminstration) and hangar, Porter St., East Boston, to J. P. Keating, 80 Boylston St., $200,000. Est. $250,000. Noted Oct. 8.

Mass., Boston—See "Excavation, Drainage, Irrigation, Levees, River and Harbor."

Tex., Dallas—United Air Lines, National Air Transport Div., c/o A. Epstein, 5936 South Cicero Ave., Chicago, Ill., and W. H. Philip, 2 story (office section), 121 x 148 ft., brick, rein.-con. stone, steel hangar, Love Field, to Austin Co., Allen Bldg., Dallas, and 510 North Dearborn St., Chicago, Ill.

POWER AND LIGHTING

PROPOSED WORK

Mass., Waltham—City, traffic lights on Main St. $15,000 appropriated.

Okla., Oklahoma City—Oklahoma Natural Gas Corp., South Boston St., Tulsa, T. R. Weymouth, pres., preliminary plans natural gas main extensions in distribution system, $250,000. Private plans.

Okla., Oklahoma City—Phillips Petroleum Co., Bartlesville, A. H. Riney, supt., preliminary plans 35,000 lin. ft. 6 in. wet gas pipe line in Oklahoma City oil field. $30,000.

Texas — West Texas Utilities Co., Abilene, 9 mi. 12 k.v. transmission line from Chillicothe to Odell, also erecting equipment sub-station at Odell. Private plans.

BIDS ASKED

Calif., Glendale—City Council taking bids ornamental lighting system on Brand Blvd., from Arden Ave. to Southern Pacific R.R., incl. 254 combination trolley and lighting poles with 2 lighting units each to be special city design of c.i. and steel. To exceed $25,000. Work to be done under Vrooman Act. J. C. Albers, City Hall, engr. Noted Sept. 3.

CONTRACTS AWARDED

Calif., Oakland—W. W. Campbell, city clk., ornamental lighting system in East 14th St., incl. 136 standards with underground system, to Alta Electric Co., 938 Howard St., San Francisco, $43,750. Noted Oct. 1.

Calif., Pasadena — City Council, ornamental lighting system on Colorado St. from Bway. to El Moline Ave., to incl. 60 Union metal double light standards, to H. C. Reid & Co., 1269 South Citrus St., **Los Angeles, $38,825**.

Minn., Rochester — Bd. P. Utility, A. J. Lantfer, secy., installing 33 kv. underground transmission line, to L. A. Kepp Electric Co., Rochester, $26,160.

Pa., Phila.—See "Unclassified."

PARKS AND SPORTS

PROPOSED WORK

Conn., New London—Garden Clubs of Connecticut, C. Scott, ch. executive com., 23 Atwood St., Hartford, developing 60 acre tract for arboretum, incl. nursery, necessary buildings. $100,000. Private plans. Connecticut College for Women, Mohegan Ave. co-operates.

Mass., Prides Crossing—Kendall Hall School, Hale St., new wing addition to gymnasium. $25,000 or more. Walker & Walker, 250 Stuart St., Boston, archt.

Mass., Revere—City, A. A. Cassassa, mayor, 1 story locker. $25,000.

N. J., Avon-by-the-Sea—Bd. City Comrs. bathing pool, concession booths, etc. $150,000. Architect not appointed.

N. Y., North Beach—Dpt. Parks, W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, park, Flushing Bay. $250,000.

Pa., McKeesport—Jefferson Memorial Park Assn., H. C. Neal, pres., McKeesport Memorial Park, incl. 200,000 cu.yd. grading, roadways, sewers, water lines, mausoleum, chapel near here, $1,000,000. A. E. Hurley, Detroit, Mich., archt. R. S. Pinner, Inc., 811 Fox Theatre Bldg., Detroit, Mich., landscape archts. R. C. Bayne, 500 5th Ave., engr.

BIDS ASKED

N. Y., New York—Oct. 29, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract, plumbing, drainage, heating, bleacher stands for Evander Childs High School Athletic Field, Gun Hill Rd., Magenta St., Barnes and Wallace Aves., for Bd. Educ., 500 Park Ave.

N. Y., Port Richmond—C. A. Duke, archt., 11 West 42nd St., bids about Nov. 15, general contract 1 story, steel, concrete, ball park, stadium for Staten Island Baseball Club, c/o M. T. Gordon. Noted Oct. 15.

CONTRACTS AWARDED

Ark., Little Rock—Little Rock Baseball Assn., structural steel, rein.-con. grandstand bleachers, to McGregor & Pickett, 113½ West 3rd St.

N. J., Paterson—Bd. City Comrs., City Hall, rein.-con. stadium, to M. A. Carty, 78 Summit Ave., Phillipsburg, Pa., $108,300; plumbing, to F. A. McBride, 327 Grand Ave., $15,392; heating, to Standard Plumbing & Heating Co., 181 Ellison St., $4,095; electrical work, to Independent Electric Constr. Co., 20 Howe Ave., Passaic, $5,694; steel work, to J. K. Cooke & Son, 210 Hudson Blvd., Clifton, $11,984. Grand total $145,465.

N. Y., Brooklyn—Park Bd., W. R. Herrick, pres. Park Dpt. Arsenal Bldg., Central Park, New York, improving north addition Brooklyn Botanical Garden, to A. Ross, $24,045. Noted Sept. 17.

N. Y., New York—Park Dpt., Arsenal Bldg., Central Park, field house in High-bridge Park, to H. W. Banks Co., $11,700; installing heating coils, Palm House, to S. Burke, $990. Noted Sept. 17.

N. Y., Rockaway—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, general contract bathing pavilion, Jacob Riis Park, to R. J. Murphy, 1751 Astor Ave., $368,000; plumbing, to Forsythe Plumbing Heating Co., 153 Baxter St., New York, $38,870 electrical work, to Austin & Moore, Inc., 87 Wilber Ave., Long Island City, $20,800; heating, to Lossack-Gaynor Corp., 119 Prospect St., Long Island City, $3,990. Grand total $431,660. Noted Sept. 17.

HEATING AND VENTILATING

CONTRACTS AWARDED

Mass., Gloucester—Addison Gilbert Hospital, 298 Washington St., heating system in hospital, to L. E. Andrews & Co., 121 Main St. Est. $25,000 or more. Noted Oct. 1.

Tenn., Murfreesboro—State Bd. Educ., Senate Chamber, Capitol Bldg., Nashville, P. L. Harned, chn., heating and power plant, at State Teachers College, to Foster & Creighton, 4th & 1st Natl. Bank Bldg., Nashville, $25,000.

UNCLASSIFIED

PROPOSED WORK

Calif., San Francisco—CONCRETE FENCES, STEPS, etc.—City and San Francisco Co. improvements on Telegraph Hill, incl. concrete approaches concrete ornamental fencing, steps, landscape work, $150,000. A. Brown, Jr., 251 Kearny St., archt.

N. Y., Pocantico Hills—STABLES, etc.—J. D. Rockefeller, Jr., 26 Bway., New York, stables, silo. $150,000.

Pa., Meadville—CULVERT—City, S. Maxwell, clk., 2,500 lin.ft. concrete culvert, Linden St. $50,000. R. Phillips, City Hall, engr.

Tex., Corpus Christi—SHIPPING PLANT—R. Campbell & T. Rosenblum Co., Corpus Christi, shipping plant 400 ft. long, 38 ft. wide, probably lumber, corrugated iron construction.

Tex., Texas City—PIPE LINE—See "Factories and Mills."

Wis., Baldwin — REPEATER STATION — Amer. Telephone & Telegraph Co., 311 West Washington St., Chicago, Ill., 1½ story, 50 x 50 ft. rein.-con., brick repeater station. $40,000. Private plans.

BIDS ASKED

Kan., Marysville—COAL CHUTES—See "Contracts Awarded."

Michigan—CULVERT—Oct. 29, by H. W. Hagaman, div. engr., 208 Kresge Bldg., Port Huron, 6 x 6 ft. concrete slab culvert, Contr. MO79-2, Contr. 2, Tuscola Co., for State Hy. Comn., Lansing.

New Jersey—PILE CYLINDER—Nov. 2, by State Hy. Dpt., Trenton, steel sheet pile cylinder around pivot pier of Passaic River swing bridge on Lincoln Hy., Route 25, Hudson and Essex Counties. A. L. Grover, ch. engr.; adv. E.N.-R. Oct. 22.

N. Y., Geneva—REFRIGERATION—Oct. 29, by Comrs. Educ., Education Bldg., Albany, refrigeration equipment, horticultural building, New York State Agricultural Experiment Station.

N. Y., New York—PLUMBING—Oct. 27, by Dpt. Hospitals, J. G. W. Greeff, comr. Municipal Bldg., plumbing alterations in Cement Buildings, 1, 3, 4, 5, 8 and 9, at Riverside Hospital, North Brother Island.

Tex., Tyler—FISH HATCHERY—**Oct. 27,** by Game, Fish & Oyster Comn., fish hatchery addition, incl. 4,850 lb. reinforcing steel, 38,500 cu.yd. excav., 272 ft. channel iron, 510 ft. each 10 and 6 in. c.i. pipe, 14 c.i. gate valves, 14 irrigation gates with 4 ft. frame, 196 ft. 8 in. pure iron corrugated galvanized pipe.

CONTRACTS AWARDED

Kan., Marysville—COAL CHUTES—Union Pacific R.R. Co., 15th and Dodge Sts., Omaha, Neb., G. J. Adamson, ch. engr., 2 large automatic coal chutes, 3 sand and 4 water columns near here, own forces. $130,000.

Tex., Beaumont—BARGE TERMINAL—City treated piling and timber rice barge terminal. Owner builds, under supervision W. S. Hammon, dir.

Pa., Phila.—CABLE SYSTEM, etc.—Dpt. City Transit, City Hall Annex, C. E. Myers, dir. Contr. 324, underground cable system, distribution cable system, subway station concourse, lighting and auxiliary power systems for City Hall Concourse and West Phila. Branch Broadway Street Subway, to W. V. Pangborne & Co., 1923 West Montgomery St., $393,203. Noted Sept. 22.

Vt., Salisbury — FISH HATCHERY — State Fish and Game Dpt., Montpelier, fish hatchery, to Leonard & Zeeman, 100 South Main St., Middlebury, $18,611. Est. $25,000.

N. B., East St. John—GRAIN OFFICES, PASSENGER and CATTLE SHEDS—Canadian Pacific Ry. Co., Montreal, Que., J. M. R. Fairbairn, ch. engr., rebuilding grain offices, station and cattle sheds, recently destroyed by fire, to E. G. M. Cape & Co., 620 Cathcart St.,

---

MATERIALS

PROPOSED WORK

WATER PIPE—**Woodland, Calif.**—City purchasing 1,500 ft. 6 in. c.i. water pipe. J. H. Laughenour, city clk.

BIDS ASKED

CAST IRON PIPE—**Glendora, Calif.**—Oct. 27, by City Council, 6,500 lin.ft. 8 in. and 5,000 lin.ft. 6 in., c.i. pipe, Class 250, centrifugally cast, U. S. Master Specifications. F. Long, city clk.

BRIDGE LUMBER, etc.—**Atlantic, Ia.**—Nov. 2, at office Auditor Cass Co. 324,419 B. F. untreated fir lumber, 106,667 B. F. creosoted fir lumber, 12,400 lin.ft. creosoted piling. G. F. Canon, Atlantic, co. engr.

BRIDGE LUMBER—**Creston, Ia.**—Nov. 10, at office Auditor Union Co., 220,000 F.B.M. creosoted bridge lumber, 4,500 ft. creosoted piling. Address County Engineer, Creston.

BRIDGE LUMBER, etc.—**Nevada, Ia.**—Nov. 4 at office Auditor Story Co., 1 carload 3 in. x 12 in. x 16 ft. full sawn fir bridge plank, 2 carloads creosoted piling and timbers, f.o.b. cars Nevada. Address County Engineer or Auditor, Nevada.

PORTLAND CEMENT—**New York, N. Y.**—Oct. 28, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., 5,000 bags portland cement, 4,000 cu.yd. sand grit, 3,000 cu.yd. ¾ in. stone.

CONTRACTS AWARDED

CAST IRON PIPE—**Glendora, Calif.**—City Council, City Hall, 2,200 ft. 6 in. centrifugally cast c.i. pipe U. S. master Specifications, from Los Angeles Stock and 800 ft. same, mill shipment, to Amer. Cast Iron Pipe Co., 412 West 6th St., Los Angeles at $0.5575 and $0.516 per ft. respectively.

STEEL PIPE, etc.—**Detroit, Mich.**—Dpt. Water Sppply, 1,065 ft. 42 in. diam. steel welded pipe with dresser couplings, manholes and reinforcing rings attached, to United Welding Co., 6350 Epworth Blvd., $10,243.

BRIDGE STEEL—**St. Louis, Mo.**—St. Louis-San Francisco Ry. Co., F. G. Jonah, ch. engr., 230 tons bridge steel, to Virginia Bridge & Iron Wks., Roanoke, Va.; 100 tons, to Mississippi Valley Structural Steel Co., 3117 Big Bend Blvd., Maplewood.

STEEL—**Helena, Mont.**—City, 73 tons structural steel to Minneapolis Steel & Mchy. Co., 225 2nd St. S., Great Falls, at $76.20 per ton, total $5,502; 124 tons reinforcing steel, to Caird Eng. Wks., Helena, at $52 per ton, total $6,099. Noted Sept. 25.

PORTLAND CEMENT, etc.—**Brooklyn, N. Y.**—H. Hesterberg, pres. Broklyn Boro, Boro Hall 1,000 bbl. cement to City Sand & Gravel Co., 32 Court St., $1,988; 10,000 cu.yd. steam ashes and 15,000 cu.yd. asphaltic sand, to M. F. Hickey Co., foot 6th St., $12,300 and $12,600 respectively; 400,000 gal. asphalt cement, to Warner Quinland Co., 2 Park Ave., New York, $12,080; 1,200 tons limestone to New York Trap Rock Co., 250 Park Ave., New York, $7,428; 3,000 cu.yd. binder stone, to Hudson River Stone Co., $5,400. Grand total $51,796. Noted Sept. 24.

HYDRANT KEYS, etc.—**New York, N. Y.**—P. J. Dooling, comr. Purchase, Municipal Bldg., hydrant keys and sewer bars, to Edson Eng. Co., 1860 Bway., $329; hose reel cards, to C. Hvass & Co., 508 East 19th St., $2,917. Noted Oct. 1.

EQUIPMENT

BIDS ASKED

GRADERS—California—Oct. 30, by State Purchasing Agent, Sacramento, two 8 ft. "high lift" type and twelve or more 8 ft. heavy duty leaning wheel graders, 3 or more heavy duty 7 ft. leaning wheel graders, 10 or more 8 ft. leaning wheel graders with scarifier attachment, 4 or more 7 ft. wheel graders. Requisition 12419.

PUMP—Denver, Colo.—Garden Farm Dairy, P. O. Box 363, in market 300 g.p.m. at 90 lb. pressure centrifugal or turbine pump with 220 volt motor.

VENTILATING FANS, etc.—**Boston, Mass.**,—Nov. 3, by Transit Dpt., 1 Beacon St., furnishing equipment, for Boston and East Boston Ventilation Buildings of Traffic Tunnel, furnishing, installing fans with motors for each, or furnishing, installing ventilating fans or furnishing delivering motors. E. R. Springer, Transit Dpt., engr. Noted Sept. 17, under "Bids Asked."

ELECTRIC EQUIPMENT—East Gardner (sta. Gardner), **Mass.** — Oct. 27, by Dpt. Mental Diseases, Commonwealth of Massachusetts State House, Boston, electric equipment, piping and equipment, 3 watertube boilers, boiler settings, 3 double side dump stokers, radial brick chimney, coal handling apparatus, coal trestle and track. A. B. Franklin, Inc., 38 Chauncey St., Boston, engr.

PORTABLE TOOL BOXES—Brooklyn, N. Y.—Oct. 28, by H. Hesterberg, pres. Brooklyn Boro, fifteen 4-wheel portable tool box to Bureau Hys.

CONTROL EQUIPMENT—Phila., Pa.—Oct. 27, by Dpt. City Transit, C. E. Myers, dir., City Hall Annex, control equipment, incl. fencing, railings, gates, grills, hand rails, baggage boards, signs, ticket booths, passimeters and turnstiles in Market, Vine, Spring Garden and Fairmount Stations of West Philadelphia Branch of Broad Street Subway in Ridge Ave. and 8th St., Contr. 319.

CONTRACTS AWARDED

WATER METERS—Oakland, Calif.—East Bay Municipal Utility Dist., meters for water distributing system, to Neptune Meter Co., 320 Market St., San Francisco, $9,190.

ROLLING DOORS—San Francisco, Calif.—State Bd. Harbor Comn., Ferry Bldg., 7 steel rolling doors for Pier 39, to Gunn Carle Co., Ltd., 444 Market St., $6,932. Noted Sept. 17.

PASSENGER CARS etc.—**New York, N. Y.**—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., 500 passenger cars, to Amer. Car & Fdry. Co., 30 Church St., motors, to General Electric Co., 120 Bway., $2,392,500, electrical equipment, to Westinghouse Mfg. Co., 150 Bway., Grand total $14,154,000. Noted Sept. 3.

FOREIGN

Mexico—J. M. Crofton, Monterrey and Mexico City, sketches several store and hotel buildings throughout Mexico. $5,000,000. Private plans.

Mexico—Aqua Caliente Jockey Club, c/o J. M. Crofton, Monterrey, plans about 5 story, part basement, rein.-con., brick, stone, stucco casino, hotel, resort, golf course, plain found., at Topo Chico, near Monterrey. $400,000. Private plans.

Mexico, Lower California — Government, Mexicali, macadam paving road from Tia Juana to Ensenada, to Mexican Cubillas Scherer Co., Tia Juana, $150,000.

New Zealand, Invercargill—Oct. 28, by City Clerk centrifugal low-lift pumping plant, incl. motors, control gear.

New Zealand, Wellington—Nov. 10, by Secretary Posts & Telegraph Dpt., 5,650 condensers and 2,300 lamp caps.

New Zealand, Wellington—Nov. 12, by City Clerk, supplying Venturi meter and automatic controller, also pump, motor and control gear.

New Zealand, Wellington—Nov. 21, by Stores Dpt., General Post Office, 4 and 5 conductor cords and 2 conductor and 3 conductor switchboard cords.

New Zealand, Wellington—Nov. 30, by General Post Office, 50 moulded cases, 50 moulded mictrotelephone cradels and 50 plunger assemblies for automatic table telephones.

New Zealand, Wellington—Dec. 15, by Ministry Pub. Wks., 50,000 v. oil immersed circuit breakers.

New Zealand, Wellington—Feb. 29, by General Manager New Zealand Govt. Railways, 3 automatic railway sub-stations.

South Africa, Johannesburg—Metro-Goldwyn-Mayer Corp., Johannesburg, taking bids general contract theatre. $700,000. T. W. Lamb, 570 7th Ave., New York, archt. Noted Aug. 12.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

N. J., Elizabeth—Martha Curtis Hotel Corp., 33 West 42nd St., New York, taking bids general contract 5 story basement, 85 x 90 ft., brick, steel, Watson Ave. $150,000. S. Malkind, 93 Court St., Brooklyn, archt.

N. J., Jersey City—Palvin Realty Co., V. Palmeri, pres., 258 Barrow St., taking bids on separate contracts 4 story, basement, brick, steel, York St. $150,000. A. Davis, 140 Montgomery St., archt.

N. J., Kearny (sta. Arlington) — Verona Constr. Co., 60 Park Pl., Newark, taking new bids general contract 3 story, basement, 95 x 115 ft., brick, steel, new, Belgrove Dr. and Rose St. $150,000. Former bids rejected. Harris & Sohn, 17 Mechanic St., Newark, archts. Noted Oct. 1.

N. Y., Bayside—See "Contracts Awarded."

N. Y., Long Island City—See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. J., North Bergen—See "Contracts Awarded."

N. Y., Queens Village—See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

N. Y., St. George—See "Contracts Awarded."

N. Y., Springfield Gardens—See "Contracts Awarded."

CONTRACTS AWARDED

Mass., Framingham—Kendall Hotel, c/o F. H. Hilton, Hemenway Bldg. reconstructing 4 story, basement, brick, steel hotel, plain found., to Oliva Bros., 410 Union Ave. Est. $150,000. Noted Sept. 24.

N. J., North Bergen—G. Bone, 138 Columbus Ave., 3 story, basement, brick, steel, Grand Ave., separate contracts. $150,000. G. F. Bial, 145 Summit Ave., Union City, archts.

N. Y. Bayside—Kings Builders, 66 Court St., apartment, 217th St. and 48th Ave., separate contracts. $150,000. D. Driesler, Jr., 153 Remsen St., Brooklyn, archt.

N. Y., Long Island City—T. Berger, 31-36 37th St., 4 story, basement, brick, steel, 43rd St. and 30th Ave., separate contracts. $150,000. Wuest & Bailey, 32-02 30th Ave., Astoria, archts.

N. Y., Long Island City—Bradard Land Corp., 39-35 Queens Blvd., 4 story store, apartment, Queens Blvd., and 39th Pl., separate contracts. $150,000. A. Farber, 16 Court St., Brooklyn, archt.

N. Y., Long Island City—Grauff Homes, Inc., 2458 84th St., Brooklyn, apartment, 47th St. and 25th Ave., separate contracts. $215,000. A. Farber, 16 Court St., archt.

N. Y., Long Island City—Schuzzain Building Corp., 319-24 112th St., 4 story, 28th St. and 33rd Ave., separate contracts. To exceed $175,000. Wuest & Bailey, 32-02 30th Ave., Astoria, archts.

N. Y., New York—Brunswick Realty Co., 239 4th Ave., R. P. Zebel, pres., apartment, store, 10 East 29th St., separate contracts. $150,000. W. E. Volckening, 145 West 45th St., archt.

N. Y., Queens Village—Cornelia Constr. Co., 220 West 42nd St., New York, apartment, Cornelia St. and Wyckoff Ave., separate contracts. $150,000. Malkind & Weinstein, 93 Court St., Brooklyn, archts.

N. Y., St. Albans—Masterbilt Homes, Inc., 220th St. and Foch Blvd., Jamaica, apartment, 220th St. and 116th Rd., separate contracts. $150,000. J. Cahill, 155-28 Jamaica Ave., Jamaica, archt.

N. Y., St. Albans—Rashhoune Realty Corp., 16 Court St., 6 story, 106x175 ft. apartment, Bown St. and Roosevelt Ave., separate contracts. $250,000. Kavy & Kavoitt, 350 Stone Ave., Brooklyn, archts.

N. Y., Springfield Gardens (Ind. br. Jamaica)—Harrow Holding Corp., Springfield Gardens, apartment, Murdock Ave. and 219th St., separate contracts. $350,000. Private plans.

Nev., Las Vegas—Virginia Hotel Corp. Ltd., J. Doyle, pres., 650 South Spring St., Los Angeles, Calif., 7 story, basement, 125 x 140 ft., rein.-con. hotel, 5th and Carson Sts., to W. O'Neill, Ray Professional Bldg., $250,000.

N. Y., St. George—St. George Tower Corp., J. Black, pres., 29 Sherman Ave., Tompkinsville, 4 story, basement, brick, steel, Monroe Ave. and 4th Pl., separate contracts. $150,000. M. G. Uslan, 57 Bay St., archt.

CLUBS

PROPOSED WORK

Mass., Holyoke — Y.M.C.A., A. W. Morse, new Y.M.C.A. building, Essex and Maple Sts. $400,000. Private plans.

N. J., Westfield—Westfield Lodge 1585 B.P.O.E., 322 Elm St., 2 story, basement, brick, steel club, East Broad St. $150,000. **Maturity probably soon.** Architect not apointed.

HOSPITALS

PROPOSED WORK

Wis., Appleton — Wisconsin Chiropractors Assn., H. C. Gauger, Prairie du Chien, rein.-con., brick, state clinic building. $150,000. Architect not appointed.

Que., Montreal—St. Pauls Hospital, 2210 Maisonneuve St., plans by R. Gariepy, 29 St. James St., hospital for contagious diseases, Sherbrooke and Moreau Sts. $1,500,000.

BIDS ASKED

Mass., Fall River—Union Hospital, 330 Prospect St., taking bids 5 story, basement, brick, steel nurses home, Prospect St. $150,000. E. I. Marvel, 209 Bedford St., archt. Fox & Gale, 3 Hamilton Pl., Boston, assoc. archts. Noted Aug. 27.

CONTRACTS AWARDED

Ind., Logansport—Comrs. Indiana Insane Hospital, 2 story, basement, 132 x 203 ft., rein.-con., brick, stone, steel hospital, to H. G. Christman Constr. Co., South Bend. $133,829. Noted Sept. 3.

Mass., Belmont — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, 2 story, basement, brick, stone assembly, plain found., at state school, to Klayman Constr. Co., 92 Hazelton St., Mattapan. Est. $150,000. Noted July 16.

N. Y., New York—Dpt. Hospitals, Municipal Bldg., general contract altering and constructing addition at Harlem Hospital, Lenox and 5th Aves., to Pstay & Fuhrman, Inc., 108 West 10th St., $1,330,000; plumbing, to P. R. Tully Co., Inc., 403 West 103rd St., $234,000; heating, to D. J. Rice, Inc., 41-50 38th St., Long Island City, $329,000; electrical work, to Lord Electric Co., 105 West 40th St., $71,780. Grand total $1,964,780. Contracts awarded in September. Noted July 16.

N. Y., Staten Island—J. G. W. Greeff, comr. Dpt. Hospitals, Municipal Bldg., New York, general contract constructing Pavilions A, B, C and D, to Rosoff Bros., Inc., 1014 Gates Ave., Brooklyn, $529,700. Noted Sept. 10.

Que., Vallefield — Sisters of Providence hospital, de Salaberry St., to A. Gratton & Sons, 1117 St. Catherine St. W., Montreal. $500,000.

CHURCHES

PROPOSED WORK

N. J., Allwood — Presbyterian Church, c/o C. H. Reis, Inc., Allwood, 2 story, basement, brick, steel, West Passaic Ave. $150,000. **Maturity probably soon.** Architect not appointed.

Wis., Waupaca—St. Mary Magdalene Congregation, A. O. Rielander, pastor, rein.-con., stone church, Badge St. $150,000. Architect not appointed.

BIDS ASKED

Md., Baltimore—Oct. 31, by Frohman, Robb & Little, archts., 726 Jackson Pl., Wash., D. C., 2 story, 80 x 164 ft., local stone, cut limestone, tile, marble, iron, steel, hollow tile, brick, rein.-con. slabs, University Ave. and St. Paul St., for Protestant Episcopal Church, A. C. Powell, chn., Stoney Run and University Parkway.

CONTRACTS AWARDED

N. J., Lincoln Park—St. Andrews Mission, Lincoln Park, general contract 1 story, basement, brick, steel, parish house, auditorium, to A. A. Hanson, Lincoln Park, est. $150,000.

N. J., Newark—Second Presbyterian Church, L. H. Clee, pastor, 294 Mount Prospect Ave., 2 story, basement, 80 x 120 ft., brick, steel, plain found., to Carlson Co., Walnut St., Montclair. Est. $200,000. Noted Sept. 3.

N. Y., Brooklyn—Parish of Immaculate Heart of Mary, 119 East 4th St., general contract 75 x 94 ft. church, to P. Rattigan, 326 10th St. Est. $200,000. Noted Aug. 27.

SCHOOLS

PROPOSED WORK

Calif., Beverly Hills—Bd. Educ., Los Angeles, plans by A. S. Nibecker, Jr., Chamber of Commerce Bldg., Los Angeles, group high school buildings, incl. physical education building, $50,000-$60,000, 12 unit classroom $84,000, additional equipment $20,000, all at 241 Moreno Dr.

Calif., Claremont—Claremont School Dist. election $198,000, additional units at high and elementary schools. Marsh, Smith & Powell, Architects Bldg., Los Angeles, archts.

Calif., Los Angeles—School Dist. plans by S. P. Hunt, Laughlin Bldg., 3 story; Class "a" rein.-con., brick addition, Juanita Ave. $150,000.

Calif., Los Angeles—Los Angeles City School Dist. plans by A. S. Nibecker, c/o Bd. Educ., group fireproof high school buildings, Moreno Dr. $150,000.

Calif., San Diego—State of California plans by W. H. Wheeler, 501 Spreckles Theatres Bldg., hollow tile, concrete gymnasium and women's faculty building, 9,225 sq.ft. floor space. Mediterranean Spanish type architecture, incl. office, shower, locker rooms, bleachers to seat 1,200, for State Teachers College. $152,000. **Maturity Nov. 1.**

Conn., Stamford—Oct. 31, by City School Bd., 2 story, basement, 90x100 ft., brick, steel addition to Rice Junior High School, South and State Sts., $200,000, Emmens & Abbott, Washington Bldg., archts.

Mass., Brookline (br. Boston)—Town, E. R. Caverly, supt. schools, revised plans by Kilham, Hopkins & Greeley, 9 Park St., Boston, 2 and 3 story, basement, irregular sized, brick high school addition, plain found., Greenough St. $300,000. Noted Aug. 20.

Mass., Haverhill—Sacred Heart Church, J. F. Kelleher, 6 Carlton Ave., pastor, plans by J. Flaherty, Green Harbor, Mansfield, and soon takes bids 2 story, basement, brick, stone, steel school, plain found., Doane St. $150,000. Noted June 25.

Constr. News page 155

Schools (Continued)

Mass., Norton—Wheeton College, J. E. Park, pres., sketches by Cram & Ferguson, 248 Boylston St., Boston, 2½ story, basement, students alumnae building to contain theatre, on campus, $200,000.

Mass., Quincy—City, P. Building Dpt., City Hall, plans by Frank Irving Cooper Corp., 47 Winter St., Boston, 2 story, basement, brick, steel addition to North Junior High School, $150,000.

Mass., Winchester—Town, H. W. Stevens, Town Hall, sketches 2 story, basement school. $150,000. Architect not appointed.

Mass., Worcester—City, W. J. Cookson, chn. school comn., Junior High School, brick, steel, West Boylston St. $150,000 or more. Architect not appointed.

Mo., St. Louis—Bd. Educ., 911 Locust St., sketches 3 story, rein.-con., brick, stone, Carondelet Dist. $300,000. E. T. Friton, c/o owner, building comr.

N. J., East Orange—Bd. Educ., 19 Winan St., 2 story, basement, brick, steel, rein.-con. school, eastern section. $150,000. **Maturity probably soon.** Architect not appointed.

N. J., Fairlawn—Bd. Educ., Boro Hall, Roosevelt School, 2 story, basement, brick, steel, $150,000. **Maturity probably soon.** Architect not appointed.

N. J., Jersey City—Bd. Educ., Administration Bldg., Harrison Ave., sketches by J. T. Rowland, Jr., 30 Journal Sq., and bids about Nov. 15, 2 story, basement, brick, steel, rein.-con. $185,000.

N. J., Piscatawaytown—Bd. Educ., Raritan Twp. revised sketches 2 story, basement, brick, steel, rein.-con. addition Oak Tree School, $150,000. Jensen & Rasmussen, 218 Smith St., Perth Amboy, archts.

N. J., Waldwick—Bd. Educ. sketches by Hacker & Hacker, 201 Main St., Hackensack, 3 story, basement, brick, steel rein-con. school. $150,000. Noted Sept. 24.

N. Y., Clinton—Hamilton College, gymnasium, $425,000.

N. Y., Pocantico Hills—Village Bd. Educ. school. $160,000.

Pa., Glenshaw—Bd. Educ. Shaler Twp., F. C. Koussman, pres., bids probably in November, 3 story, basement, brick, hollow tile, grade and high school, incl. auditorium, gymasium, manual training rooms, Mt. Royal Blvd. $220,000. Ingham & Boyd, Empire Bldg., Pittsburgh, archts.

Pa., Phila.—Bd. Educ., E. Merchant, bus. mgr., 19th and Ludlow Sts., plans by I. T. Catherine, 19th and Ludlow Sts., rein.-con., brick, plain found., Haines St. and Germantown Ave.

Wash., Seattle—Bd. Regents University of Washington, plans by A. H. Albertson, Henry Bldg., Law School Building, Champus, $225,000.

Ont., Sudbury—Bd. Educ., J. E. Lowe, secy., 18 Elm St., plans by P. J. Gorman, Mackay Bldg., Technical and High School addition, $250,000.

BIDS ASKED

Del., Wilmington—Oct. 26, by Bd. Educ., City Hall, rein.-con., brick, steel school addition, plain found., Bayard and Clayton Sts. **Guilbert** & Betelle, 20 Branford Pl., Newark, N. J., archts.

Mass., Fall River—See "Contracts Awarded."

Mass., Wellesley—Wellesley Colege, c/o C. B. Hodgate, supt., taking bids (invited list of contractors) 4 story dormitory, to exceed $150,000. W. T. Aldrich, 30 Newbury St., Boston, archt.

Neb., Wayne—Nov. 9, by C. W. Taylor, supt. State Teachers College, State Bd. Control, 3 story, concrete, brick girls' dormitory, $150,000. A. D. Baker, Clinic Bldg., Grand Island, archt.

N. J., Bayonne—C. H. Ziegler, archt., 26 Journal Sq., Jersey City, bids about Dec. 1, general contract 2 story, basement, brick, steel chapel, garage, Hudson Blvd., Hudson County Parental School, 1241 Hudson Blvd., for $150,000.

N. J., Montclair—Nov. 10, by Bd. Educ., 22 Valley Rd., 2 story, basement, brick, steel, rein.-con. addition to Rand School Chestnut and Fullerton Sts. $150,000. Starrett & Van Vleck, 393 7th Ave., New York, archts.

N. J., Springfield—Bd. Educ. bids about Nov. 15, general contract 2 story, basement, brick, steel, rein.-con. high school. $300,000. J. T Simpson, 744 Broad St., Newark, archt. Noted Oct. 15.

N. J., Sussex—Nov. 6, by Bd. Educ., 2 story, basement, brick, steel high school. $155,000. Jacoby & Everett, Commonwealth Bldg., Allentown, archts.

N. J., Trenton—Nov. 4, by Guilbert & Betelle, archts., 20 Branford Pl., Newark, 2 story, basement, 126 x 132 ft., rein.-con., steel health and physical education building, for Trenton State Teachers College and State Normal School, Lake Blvd., between Pennington Rd. and Ewingville, Lawrenceville Rd., Ewing Twp., for State Bd. Educ., Court House. Noted May 28.

N. J., Westfield—Oct. 30, by Bd. Educ., Clark St., 2 story, basement, brick, steel addition to McKinley School, Osborn Ave. $150,000. Coffin & Coffin, 522 5th Ave., New York, archts.

N. Y., Greenville—Nov. 9, by Bd. Educ. Central Rural School Dist. 1, of towns Greenville, Durham, Coxsackie, New Baltimore, Cairo, Green Co., and Coeymans, Westerlo, Rensselaerville, New Scotland, Albany Co., Vanderbilt Hotel, new school. J. R. White, 109 State St., Albany, archt.

Constr. News page 156

N. Y., New York—Oct. 29, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract P. S. 85, East 187th St. from Marion to Webster Aves., for Bd. Educ., 500 Park Ave. Noted Oct. 8.

N. Y., Whitestone—Oct. 29, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract additions to P. S. 79, 15th Dr., 15th Rd., 147th and 149th Sts., for Bd. Educ., 500 Park Ave., New York. Noted Aug. 20.

CONTRACTS AWARDED

Conn., Bridgeport—City, Bd. Educ., 2 story, basement, brick, Northeast Sect., to E. & F. Constr. Co., 94 Wells St. Noted Sept. 17.

Mass., Brookline (br. Boston)—Town, C. F. Rowley, chn. Bd. Selectmen, William H. Lincoln School, 3 story, basement, brick, irregular sized, plain found., to D'Amore Constr. Co., 89 State St., Boston. Est. $390,000. Noted Sept. 24.

Mass., East Boston (sta. Boston)—City of Boston, Dpt. School Buildings, 3 story, basement, brick, limestone, plain found., Chapman Dist., to Rugo Constr. Co., 80 Boylston St., Boston, $143,747. Noted Oct. 1.

Mass., Fall River—Blessed Sacrament Roman Catholic Church, O. Boucher, pastor, 2 story, basement, brick school, South Main St., day labor. $150,000. W. R. Destremps, Borden Blk., South Main St., archt. Former contract rescinded. Noted July 30.

Minn., Minneapolis—Bd. Educ., G. F. Womrath, bus. mgr., supt., 3 story vocational school, 3rd Ave. S. and 12th St., to Madsen Constr. Co., 618 Natl. Bldg., $389,599.

N. J., Franklin Park—Bd. Educ. Franklin Twp., general contract 2 story, basement, brick, steel addition to Franklin Park School, to A. B. Lasso, 96 Woodridge Ave., Highland Park; plumbing to Adams & Mulready, 332 Benner Ave., Highland Park; heating to E. C. Stokes, Highlands, electrical work, to C. E. Benni, Piscataway; steel and iron to Hercules Iron Wks., Inc., 26 Bergen St., Newark, Est. $150,000.

N. J., Middlebush—Bd. Educ. Franklin Twp., H. Kline, pres., general contract 2 story, basement, brick, steel, rein.-con., Pine Grove Ave., to C. Garlotti, 421 Livingston St., New Brunswick; plumbing, to Adams & Mulready, 332 Benner Ave., Highland Park; electrical work, to Smith Electric Co., 338 Broad St., Trenton; steel and ornamental iron, to Elizabeth Iron Wks., 127 Franklin St., Elizabeth. Est. $150,000. Noted Sept. 24.

N. J., Union City—Bd. Educ., 415 32nd St., general contract 3 story, basement, 150x190 ft., brick, steel, rein.-con. to Reliable Constr. & Eng. Co., 604 Anderson Ave., Grantwood, $417,100, plumbing, to Jaehnig & Peoples, Inc., 223 13th Ave., Newark, $18,380; heating and ventilating, to R. G. Maupi Co., Inc., 73 South St., Jersey City, $51,567, electrical work to J. Flannery, 115 Bowers St., Jersey City, $34,990, steel, iron work, to Maxwell Spuro Co., 241 Communipaw Ave., Jersey City, $49,740. Grand total $571,777. Noted Aug. 15.

N. Y., New York—Columbia University, Bway. and 116th St., 6 story, 107x167 ft. library and School of Library Service, 521-41 West 114th St., to Marc Eidlitz, 100 East 42nd St. Est. $3,000,000. Contractor soon takes bids on structural steel and other separate contracts. Noted July 2.

N. Y., Syracuse—Bd. Contr. & Supply, City Hall, general contract Grant School, Grant Blvd., to F. McLennan Co., 363 Buckingham Rd., Syracuse, $473,735 heating, to F. Bradt Co., 113 Oakwood Ave., $85,359; plumbing, to P. C. Shane, 406 Pearl St., $41,131. Grand total $600,225.

R. I., North Kingston—Town, Superintendent Schools, Senior and Junior High School, 2 story, basement, 60 x 140 ft., brick, plain found., to H. M. Soule, 110 Brook St., Pawtucket. Est. $155,000. Noted Sept. 10.

Tenn., Cookeville—Building Com. Putnam Co. Bd. Educ. and City Comn., for Central High School, to Foster Creighton Co., 4th and 1st Natl. Bank Bld., Nashville, $100,000. Noted Sept. 22.

Tenn., Nashville — State Bd. Educ., Senate Chamber, Capitol Bldg., P. L. Harned, chn., women's vocational building, men's agricultural and vocational building at Agricultural and Industrial College, to Angle-Blackford Co., Greensboro, N. C., $277,000. Noted Sept. 17.

Wis., Green Bay—Atlas Warehouse & Cold Storage, E. R. Fisher, mgr., 4 story, 50 x 90 ft., rein.-con., brick cold storage warehouse, to J. C. Basten, 1857 William St. Est. $40,000. Noted Sept. 24.

Wis., Manitowoc—Bd. Educ., R. F. Thoke, secy., 1805 South 10th St., general contract 4 story, brick, rein.-con., steel vocational school, to Schulette Constr. Co., Manitowoc, $130,000; heating, to G. H. Kollees, Manitowoc, $33,465. Noted Sept. 28 Daily.

Wis., New London—Bd. Educ., c/o Clerk, brick, rein.-con., steel school, to W. C. Farly, New Lisbon.

THEATRES

CONTRACTS AWARDED

N. J., Trenton—T. W. Lamb, archt., 701 7th Ave., New York, general contract 1 story, basement, 80 x 160 ft., brick, steel theatre, to E. J. Smith, 202 Academy St., for Tre Theatre & Building Co., F. V. Storrs, 701 Ave., New York. Est. $150,000. N Sept. 10.

BANKS

PROPOSED WORK

N. Y., Brooklyn—First Natl. Mortg Securities Corp., soon lets general contrac story bank, Pitkin and Hopkinson Aves, $15 000. Halsey, McCormick & Helmer, 286 Ave., New York, archts. Noted Oct. 8.

BIDS ASKED

N. J., Newark—W. E. Lehman, archt., Broad St., bids about Nov. 15, general cont 2 story, basement, brick, steel, Market St. Raymond Pl., for Marzano State Bank & T Co., 15 Ferry St., $150,000. Noted Oct. 1.

N. Y., Brooklyn—Breevoort Savings Ba 522 Nostrand Ave., bids about Nov. 1, gen contract bank addition, Fulton St. and Nostr Ave. Halsey, McCormick & Helmer, 286 Ave., New York, archts. Noted Sept. 17.

OFFICES

PROPOSED WORK

Calif., Long Beach—Medical-Dental Build of Long Beach, Ltd., plans by K. Cutter, Farmers & Merchants Bldg., 9 story, 200 tower, 138 x 150 ft., steel, stone, terra co marble, tile, 5th and Pacific Sts. $750,000

Mass., Boston—Walodrf System, Inc., High St., plans by J. M. Goray & J. P. Hell man, 175 High St., 2 or more story, br stone office, restaurant, 119-123 Causeway $150,000 or more.

N. J., Englewood—R. Livingston, 13 E Palisade Ave., 5 story, basement, brick, st office, Palisade Ave. and North Dean St. $15 000. **Maturity probably soon.** Architect apointed.

BIDS ASKED

N. J., Union City—W. P. Keane, 317 Mona ery Pl., bids about Nov. 1 no revised pla general contract 2 story, basement, 75 x 10 ft., brick, steel office, store, Bergenline A and 36th St. $150,000. P. A. Vivarttas, 1 48th St., archts.

CONTRACTS AWARDED

N. Y., New York—Todd, Robertson & To Engineering Co., 347 Madison Ave., 66 sto office building, Radio City, to Hegeman Har Co., Inc., 360 Madison Ave.; 31 story offi building and International Music Hall, to Joh Lowry, Inc., 270 Madison Ave.; sound pictu theatre, to Barr, Irons & Lane, Inc., 420 Le ington Ave.; all for Metropolitan Square Corp 61 Bway. Total $50,000,000. Noted Aug. 1

STORES

PROPOSED WORK

N. J., Elizabeth—L. J. Kemig, archt., 4 Princeton Rd., soon lets general contract alte ing and constructing 2 story, basement, bri steel addition to store, office, 1147 Elizabeth Ave., for owner, c/o architect. $150,000. Not Oct. 1.

N. J., Jersey City—W. T. Grant Co., 144 Bway., New York, 2 story, basement, bri steel store, Newark Ave. and Barrow St. $250 000. **Maturity probably soon.** Private plans.

N. Y., Long Island City—Mansion Realt Corp., 2nd St. and Ditmars Ave., plans b M. Klein, 65 Court St., Brooklyn, 6 stor store, apartment, Bway and 47th St. $210,00

BIDS ASKED

N. J., Asbury Park—C. B. Cook, archt., 50 Bond St., bids about Nov. 15, general contra 2 story, basement, brick, steel store, office, fo Owner, c/o architect. $150,000. Note Sept. 10.

N. J., Long Branch—H. B. Seymour, archt 512 McClellan Ave., Long Branch, bids abou Nov. 15, general contract 2 story, basemen brick, steel store, apartments, Ocean Ave., fo Peter Realty Corp. $150,000. Noted July 3

PUBLIC

PROPOSED WORK

Calif., San Diego — COURT HOUSE — Bd Supervs. San Diego Co. sketches (2nd uni Class A annex. $250,000.

Ind., Indianapolis—LIBRARY—State, pla by Pierre & Wright, 909 Architects Bldg., rei con., Indiana limestone, Ohio St. and Sena Ave. $1,000,000. Noted July 30.

Mass., Boston—OFFICE—Commonwealth Massachusetts, Dpt. P. Wks., soon takes bi 8 story, basement, 90 x 365 ft., brick, sto steel, marble, concrete found., Nashua a Lowell Sts. $1,500,000. E. T. P. Graha 171 Newbury St., archt. Noted July 9.

Mass., Boston—POLICE STATION—City, D P. Buildings, sketches by J. M. Gray, 175 Hi St., 2 story, basement, brick, Berkley St. a Warren Ave. $300,000.

Mass., Bridgewater — FEMALE DEFECTI DELINQUENT — Commonwealth of Massachusetts, Boston, female defective delinque building at State Farm. $150,000. Archit not appointed.

Mass., Middleboro—COURT HOUSE, etc Plymouth Co. (Plymouth), plans by J. W. B Sons Co., 185 Devonshire St., Boston, alteri and constructing court house and police stat addition. To exceed $150,000.

Public (Continued)

N. J., East Orange—FIRE HEADQUARTERS—Oct. 26, by Bd. City Council, City Hall. 2 story, basement, brick, steel, Main St. and Ashland Ave. $150,000. W. F. Bower, 437 Main St., archt. Noted Sept. 17.

N. J., Essex Fells — MUNICIPAL — Bd. Boro Concil, Boro Hall, sketches by Peterkin & Bell, 285 Madison Ave., New York, 2 story, basement, brick, steel addition, Roseland Ave. $150,000. Noted Oct. 8.

N. Y., Brooklyn—HEALTH CENTER—Dpt. Health, 505 Pearl St., New York, health center, Maujor and Graham Aves. $150,000.

N. Y., Long Island City—Dpt. Health, 505 Pearl St., New York, health building, Academy St. $150,000.

N. Y., New York—HEALTH CENTER—Dpt. Health, 505 Pearl St., health center, Arthur Ave. and 176th St. $150,000.

N. Y. St. George—HEALTH CENTER—Dpt. Health, 505 Pearl St., New York, health building, Central Ave. $150,000.

N. Y., West Haverstraw—HOME—Oct. 29 (extended date), by Commissioner Dpt. Health, State Office Bldg., Albany, dining room, kitchen building, laundry, storehouse, schoolhouse, treatment building, connecting corridors, tunnels and service connections, New York State Reconstruction Home. Noted Oct. 1.

BIDS ASKED

N. Y., New York—HEALTH CENTER—Dpt. Health, 505 Pearl St., bids about Nov. 1, general contract headquarters building, baby health center, 349 East 140th St. $150,000. K. M. Murchison, 101 Park Ave., archt. Noted July 23.

CONTRACTS AWARDED

Mass., Cambridge—COURT HOUSE—Middlesex Co. Comn., W. C. Wardwell, chn., 3 story, basement, brick, stone, steel, to Matthew Cummings Co., 43 Tremont St., Boston, $246,000. Noted Oct. 8.

Calif., San Jose—COURT HOUSE—H. Pfister, clk., Santa Clara Co., brick, steel, concrete, to W. J. Ochs, Amer. Trust Bldg., San Jose, $148,-500 Noted Aug. 27.

N. Y., Kingston—TIMBER PILING—Adjutant General, Div. Military & Naval Affairs, Capitol, Albany, timber piling for state armory, to D. E. Horton Constr. Co., 716 Prudential Bldg., Buffalo, $9,009. Noted Sept. 24.

UNCLASSIFIED

PROPOSED WORK

Calif., Pasadena—MUSEUM—Pasadena Art Institute plans by C. S. Stein, 56 West 45th St., New York, 1 story, 108 x 136 ft., probably rein.-con., Carmelita Park.

N. Y. New York—ART GALLERIES—Wildenstein Galleries, 647 5th Ave., plans by H. Trumbauer, Land Title Bldg., Phila., Pa., 5 story, 19 East 64th St. $300,000.

O., Cleveland — MAUSOLEUM — Crown-Hill Cemetery, c/o C. W. Beck, treas., plans by L. E. Blue, Mayo Bldg., Tulsa, Okla., 1 story, 315 x 315 ft., granite, stone, concrete, steel, marble, Cleveland-Akron Rd. $1,000,000.

BIDS ASKED

Pa., McKeesport—MARKET—C. L. Whittaker, archt., McKeesport, taking bids (1st unit) 1 and 2 story, 110 x 195 ft., brick, steel market, temporary heating, refrigeration and climatic control, Sinclair St. and 5th Ave., to Baltimore and Ohio R.R., for J. V. Balsamo, 423 5th Ave.

Ont., Hamilton—STATION—R. L. Latham, ch. engr. Toronto, Hamilton & Buffalo Ry. Co., Hamilton, taking bids 9 story station. $3,000,-000. Felheimer & Wagner, 155 East 42nd St., New York engrs. Noted Apr. 2.

CONTRACTS AWARDED

Mass., Worcester—HOME—Jewish Home for Aged, S. Waxler, chn. building com., 3 story, 80 x 125 ft., brick, steel, tile home for aged and orphans, to E. Turgeon, 36 Exchange St., Providence, R. I. Est. $150,000. Noted Sept. 24.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Covina—PRE-COOLING PLANT—San Gabriel Valley Precooling & Ice Corp. 2 story, basement, 100 x 325 ft. e rin.-con., steel, North Citrus Ave. and Front St., Gay Eng. Corp., 2650 Santa Fe Ave., LosL Angeles. Est. $300,000. to incl. trackage, property and equipment.

Calif., Long Beach—CHEMICAL PLANT—Fields Chemical Corp. Ltd., sketches by R. D. Van Alstine, 410 East 9th St., 150 x 180 ft. plant, incl. administration building, laboratory, pump houses, on 8 acre site, Cherry Ave. and Poppy St. $50,000.

Calif., San Francisco—ICE MAKING PLANT—California Carbonic Ice Mfg. Co., c/o C. A. Winder, 200 Bush St., outdoor factory type plant (will manufacture ice from gasses of substation stacks in vicinity) 23rd and Illinois Sts. $250,000.

Calif., Upland—PRE-COOLING PLANT—Upland Citrus Arsn. plans by W. W. Ache, 1616 4th Ave., Los Angeles, rein.-con., brick precooling plant. $65,000.

Mo., St. Louis—BAKING PLANT—Kroger Grocery & Baking Co., 1311 South 39th St., sketches by E. H. Niemann, 3816 Shaw Ave., 4 story, basement, rein.-con., brick, 1311 South 39th St. $750,000 incl. equipment. Noted Oct. 15.

N. J., Bayonne—LABORATORY—Babcock & Wilcox East 3rd St., 4 story, basement, brick, steel, $50,000. Private plans.

N. J., Millville—MILL—Millville Hosiery Co., plans by N. Hulme, 1524 Chestnut St., Phila., Pa., 1 story, basement, 107x122 ft. brick, steel, mill.

N. J., Woodbridge—FACTORY—Owner, c/o E. C. Wierzbicki, archt., 175 Smith St., Perth Amboy, sketches altering and constructing 2 story, basement, brick, steel adition, Wolf Pl. and Avanal St. $40,000.

N. Y., Brooklyn — LAUNDRY — Brighton Laundry Co., 587 Sheepshead Bay Rd., revised plans by J. M. Fenichel, 468 4th Ave., New York, laundry, West 6th St. and Sheepshead Bay Rd. To exceed $60,000. Noted June 18.

N. Y., Honeywood (sta. Staten Island)—GAS PLANT—New York & Richmond Gas Co., 691 Bay St., St. George, brick artificial gas plant. $125,000. **Maturity probably soon.** Private plans.

N. Y., Rockaway—ICE MANUFACTURING PLANT—G. Bruning, 178-15 93rd Ave., Queens Village, 73x148 ft. ice manufacturing plant, Rockaway Blvd. and 234th St. $50,000. Private plans.

N. Y., Winfield — FACTORY — Vincenet Scudder, 4009 82nd St., Jackson Heights, plans by C. Stidolph, 87-01 51st Ave., Newtown, 2 story, basement, 94x100 ft. factory, 70th St. and 48th Ave.

N. Y. Woodhaven—ICE CREAM PLANT etc.—Anheuser Bush, 979 Brook Ave., New York, alterating 2 story, 164x210 ft. ice cream plant and garage, to Equity Constr. Co., 25 West 42nd St., New York,, est. exceeds $60,000. Contractor taking separate contract bids. Noted Oct. 1.

O., Cincinnati — FOOD MANUFACTURING PLANT—Kroger Grocery & Packing Co., 35 East 7th St.,, soon lets contract food manufacturing plant. To exceed $250,000. Part of $1,000,000 expansion program.

O., Eaton — ELECTRIC LIGHT PLANT — Election Nov. 3, $330,000 electric light plant.

O., Youngstown—MILL—Youngstown Sheet & Tube Co., Stambaugh Bldg., sketches electric weld pipe mill. $1,500,000. Private plans.

Tex., Laredo—PECAN SHELLING PLANT—H. E. Hutches, rep. San Antonio Pecan Growers' Assn., Bway. Ave., 1 and 2 story plant, incl. warehouse, refrigeration plant. Private plans.

Tex., San Antonio—CREAMERY PLANT—Knowlton Creamery, c/o S. E. Knowlton, 1415 West Summit Ave., 2 story, part basement, 90 x 140 ft., rein.-con., brick, plain found., off Fredericksburg Rd. $60,000. Private plans.

Tex., Texas City—OIL REFINERY, etc.—Pan-American Petroleum Corp., c/o O. D. Barker, (state agent), Amer. Natl. Insurance Bldg., Galveston, surveys large refinery, laying pipe lines to East Texas oil fields. $1,000,000.

Tex., Texton—PLANT—Texas Pub. Serv. Co., 40 Exch. Pl., New York, sketches sulphur extracting plant. $110,000. Private plans.

Wis., Baldwin—FACTORY—Western Cable & Electric Co., G. Hansen, mgr., rein.-con., brick, steel. $40,000. Architect not appointed.

Wis., DePere—PAPER MILL—De Pere Paper & Mfg. Co., M. Miller, pres., rebuilding 2 story, rein.-con., brick, recently destroyed by fire. $50,000. Architect not appointed.

BIDS ASKED

Calif., Sacramento — PRINTING PLANT — Nov. 3, by State Dpt. P. Wks., Division of Architecture, Sacramento, 2 story, basement, rein.-con. annex. $85,000. Noted June 4.

Calif., Santa Paula—PACKING PLANT—R. C. Wilson, archt., 112 South Mills St., taking bids 1 story, basement, rein.-con. addition, for Limoneira Co., 117 North 10th St. $70,000. Noted Oct. 8.

Ore., Roseburg — PACKING PLANT — See "Contracts Awarded."

CONTRACTS AWARDED

Ind., Columbia City—FACTORY—Columbia City Woolen Mills, general contract brick, steel, to W. A. Sheets, 315 Cal-Wayne Bldg., Ft. Wayne. Est. $40,000.

Ind., Indianapolis—PLANT—Real Silk Hosiery Co., 514 North Davidson St., general contract brick, steel, 514 North Davidson St., to Mead Constr. Co., 1027 Lemcke Bldg. Est. $40,000.

Ind., Muncie — PACKING PLANT — Kuhner Packing Co., 2 story, basement, 73 x 133 ft., brick, steel, tile, North Elm and 13th Sts., to G. Hitchins, Muncie. Est. $65,000.

Ind., Sheridan—CONDENSED MILK PLANT—Condensed Milk Co., general contract 3 story, 75 x 130 ft., rein.-con., brick, steel, to T. A. Moynahan Co., 710 Union Title Co., Indianapolis. Est. $40,000.

N. Y., Syracuse—SERVICE CENTER—Syracuse Lighting Co., 421 South Warren St., (3rd unit) 4 story, brick, rein.-con., to F. T. Ley & Co., 1215 Main St., Springfield, Mass. Est. $400,000.

O., Cleveland — LABORATORY — Grasselli Chemical Co., c/o H. Gronemeyer, ch. engr., Guardian Bldg., 3 story, basement, 31 x 54 ft., concrete, brick, steel, to Lundoff-Bicknell Co., B. F. Keith Bldg. Est. $60,000.

Ore., Roseburg—PACKING PLANT—Pacific Co-Operative Poultry Producers, E. J. Dixon, mgr., 361 East Washington St., Portland, poultry producers and egg packing plant, day labor, $25,000. C. D. James, Couch Bldg., Portland, archt.

Tex., Kingsville—PROCESSING PLANT—Carrot Products Corp. of Delaware, c/o J. A. Smith, Kingsville, general contract 2 story, rein.-con., concrete, plain found., to A. P. Vermesh, San Antonio. Est. $115,000.

S. C., Lyman — TEXTILE MILL — Lyman Mills, Inc., c/o Lockwood Greene, engrs., 100 East 42nd St., N w York, mill addition, to Gallivan Constr. Co., Greenville. Est. $500,000. Noted Sept. 24.

Vt., Rockingham — CREAMERY — Bellows Falls Co-operative Creamery, Bellows Falls, 3 story, 45x100 ft., concrete, to Roby Constr. Co., 1103 Main St., Manchester, N. Y. Est. $40,000.

GARAGES

PROPOSED WORK

Mass., Bridgewater — Commonwealth of Massachusetts, Dpt. Correction, State House, Boston, service building, incl. refrigeration system, at State Farm. $40,000 or more. Architect not appointed.

Mass., Danvers — G. Stahler, 15 High St., Middletown, plans by G. H. Fanning, 221 Essex St., Salem, 1 story, 60 x 100 ft. brick, concrete, rein.-con., steel service garage and showroom, plain found., Maple St. $40,000.

N. Y., New York—Five Hundred Fourteen West 23rd Street Corp., 100 Southern Blvd., plans by R. G. Cory, 30 Church St., 4 story, 98 x 122 ft. garage, storage building, 514 West 23rd St. To exceed $130,000.

BIDS ASKED

Mass., Middleboro—Nemasket Transportation Co., West Grove St., taking bids 1 story, 65 x 110 ft., steel, brick, concrete garage, plain found., West Grove St. $40,000. W. G. Harlow, 18 Pierce St., archt.

CONTRACTS AWARDED

Ind., Auburn—Beacon Oil Co., 1702 North Harrison St., Ft. Wayne, brick, steel super-service station, 6th and Jackson Sts. $40,000. Owner builds. Private plans.

Ind., Indianapolis — Great Western Oil Co., 1602 Deloss St., general contract brick, steel super-service station, near Ft. Benjamin Harrison 9 mi. from here, to C. Wacker, 142 West 32nd St. Est. $40,000.

Mass., Mattapan (sta. Boston)—City of Boston, Hospital Dpt., 1 story, brick, stone, steel garage, plain found., River St., to J. A. Singarella, Park Sq. Bldg., Boston. Est. $40,000.

POWER PLANTS

BIDS ASKED

Ind., Newcastle—Oct. 30, by Epileptics Village, rein.-con., brick, stone heating plant. $50,-000. Foltz-Osler & Thompson, 1037 Architects Bldg., Indianapolis, archts. Bevington & Williams, Inc., 1139 K. of P. Bldg., Indianapolis, engrs. Noted Oct. 1.

Mass., Gardner—Oct. 27, by Commonwealth of Massachusetts, Gardner State Hospital, Mental Diseases, Boston, 2 story, brick, steel power plant, incl. 2 turbines, 4 boilers, stokers, switchboard. $125,000-$150,000. A. B. Franklin, Inc., 25 Haverhill St., Boston, archts. Noted Sept. 3.

CONTRACTS AWARDED

Conn., Hartford — Trinity College, 1651 Broad St., 1 story, 25 x 40 ft., rein.-con., brick boiler plant addition to R. C. Bent Co., Inc., 93 Edwards St. Est. $5,000.

Ind., Ft. Wayne—Bd. P. Wks., City Hall, furnishing, installing 3 stokers, to Economy Stoker Co., 2050 Phenie St., $5,000. Noted Aug. 20.

WAREHOUSES

PROPOSED WORK

Calif., Long Beach—Graham Bros. plans by Schilling & Schilling, Farmers & Merchants Bank Bldg., 1 and 2 story, 50 x 150 ft., concrete and heavy timber warehouse.

N. J., New Brunswick—C. T. Wales, Inc., 26 French St., rejected bids 7 story, basement, 50x100 ft. warehouse, Sanford St. $150,000. Project in abeyance. Noted Aug. 27.

Pa., Erie—Standard Stoker Co., Inc., 1701 Gaskel Ave., F. C. Pickard, mgr., soon lets contract 1 story, 35 x 190 ft., cinder block metal, steel sash, tool storage and office building, concrete found., 1701 Gaskel Ave. Private plans.

Tex., Houston—Houston Compress Co., Long Reach St., granted permits 3 warehouses, equivalent to 400 x 425 ft. frame shed, 166,-800 sq.ft. floor space, Anderson St. and Houston & Texas R.R. $72,000. J. B. Townsend, Post Dispatch Bldg., listed as contractor in permits.

CONTRACTS AWARDED

N. Y., Brooklyn—Standard Oil Co. of New York, Kingsland and Norman Aves., 1 story, 50 x 150 ft. metal storage building, to Jones & Larson Corp., 58-61 55th St., Maspeth. Noted Oct. 8.

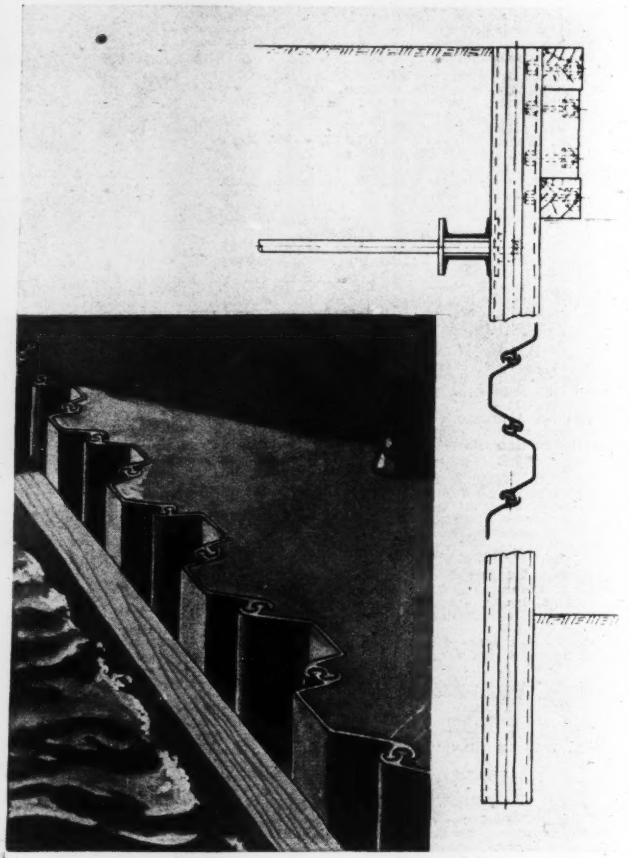
Tex., Houston—See "Proposed Work."

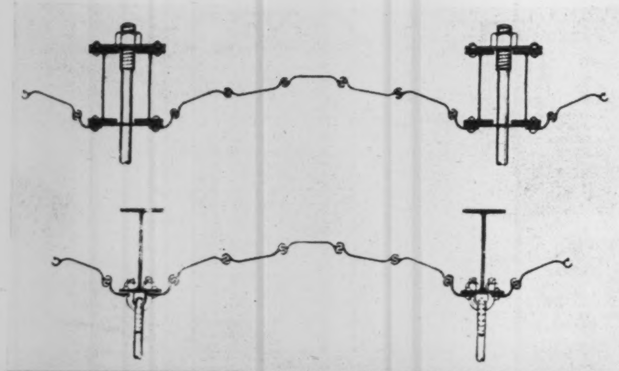
Wis., Green Bay—Bd. Educ., 523 Howe St., 2 story, basement, rein.-con., brick, to E. H. Regal Constr. Co., 134 South Adams St., $150,-000. Noted Sept. 24.

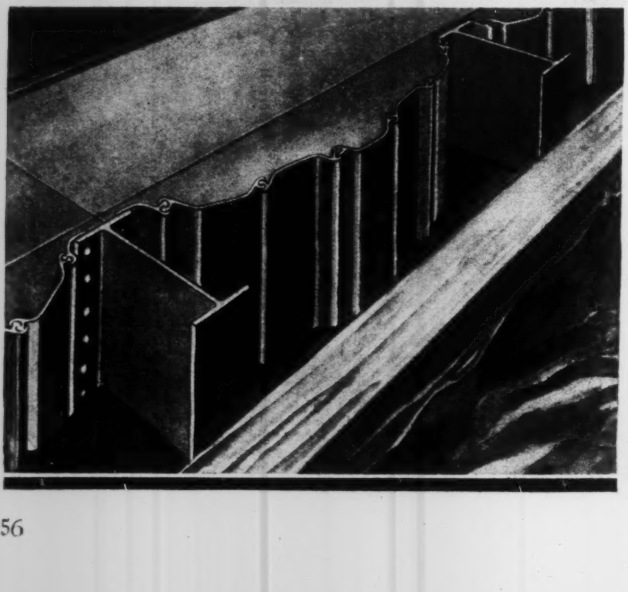
See proposal advertising on page 96

MODERN Steel WHARVES

Three efficient and economical types of modern wharf and bulkhead construction are illustrated herewith. On the right is shown the type for all depths of channel up to 25 feet. Carnegie Arch-Web Steel Sheet Piling has proved particularly efficient for this construction. A number of arch-web sections of varying weights and depths are available to meet the required strength for this range of depths. Section M110 is illustrated, with a driving width of 16", depth of 6" and a section modulus of 15.26 in.^{3} per foot of wall.







On the left are shown two types of construction for channels deeper than 25 feet. By varying the weight of the C B Sections and the spacing of the master piles, a wharf for any depth of channel and any surcharge load can be constructed. No waling is necessary in this construction.

Numerous installations have definitely proved the efficiency and economy of these three types. Carnegie Engineers are ready to consult with you at any time.

Carnegie Steel Company, Pittsburgh
Subsidiary of United States Steel Corporation 160

US STEEL

CARNEGIE *Steel Sheet* PILING